AMITY UNIVERSITY

M A D H Y A P R A D E S H

Bachelor of Technology (Biotechnology)

Programme Code: BTB

Duration – 4 Years Full Time

Programme Structure

And
Curriculum & Scheme of Examination

Batch: 2017 – 2021

AMITY UNIVERSITY

MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2017

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
BTB 101	Applied Mathematics - I	3	1	-	4	
BTB 102	Applied Physics - I	2	1	-	3	
BTB 103	Applied Chemistry - I	2	1	-	3	
BTB 104	Introduction to Computers	2	1	-	3	
BTB 105	Life Sciences-I	2	1	-	3	
BTB 106	Environmental Studies - I	2	-	-	2	
BTB 120	Applied Physics Lab - I	-	-	2	1	
BTB 121	Applied Chemistry Lab - I	-	-	2	1	
BTB 122	Programming in C Lab	-	-	2	1	
BTB 123	Engineering Graphics Lab	-	-	2	1	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BTB 141	English Langauge Usage Essentials	30	-	-		
BTB 143	Understanding Self For Effectiveness	30	-	-		
	Foreign Language - I	30	-	-		
BTB 144	French					
BTB 145	German					
BTB 146	Spanish					
BTB 147	Japanese					
BTB 48	Chinese					

SECOND SEMESTER

Compulsory Courses:						
BTB 201	Applied Mathematics – II	3	1	-	4	
BTB 202	Applied Physics - II	2	1	-	3	
BTB 203	Applied Chemistry – II	2	1	-	3	
BTB 204	Object Oriented Programming in C++	2	1	-	3	
BTB 205	Electrical Science	2	-	-	2	
BTB 206	Life Science-II	3	-	-	3	
BTB 207	Enviromentel studies II	2			2	
BTB 220	Applied Physics Lab – II	-	-	2	1	
BTB 221	Applied Chemistry Lab - II	-	-	2	1	
BTB 222	Object Oriented Programming in C++ Lab	-	-	2	1	
BTB 223	Electrical Science Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BTB 241	Introduction to Communication Skill	30	-	-		
BTB 243	Individual, Society and Nation	30	-	-		
	Foreign Language – II	30	-	-		
BTB 244	French					
BTB 245	German					
BTB 246	Spanish					
BTB 247	Japanese					
BTB 248	Chinese					

TERM PAPER DURING SUMMER BREAK

THIRD SEMESTER

Compulsory Courses:						
BTB301	Cell Biology	3	-	-	3	
BTB302	Biochemistry - I	3	-	-	3	
BTB303	Microbiology	3	-	-	3	
BTB304	Molecular Biology	3	-	-	3	
BTB305	Data Structure & Algorithms	3	-	-	3	
BTB320	Cell Biology Lab	-	-	2	1	
BTB321	Biochemistry Lab - I	-	-	2	1	
BTB322	Microbiology Lab	-	-	2	1	
BTB323	Molecular Biology Lab	-	-	2	1	
BTB324	Data Structure Lab	-	-	2	1	
BTB330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BTB341	Effective Written Communication	30	-	-		
BTB343	Problem Solving & Creative Thinking	30	-	-		
 BTB344 BTB345 BTB346 BTB347 BTB348	Foreign Language - III French German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
BTB401	Biochemistry – II	3	1	-	4	
BTB402	Genetics	3	1	-	4	
BTB403	Methods & Instrumentation in Biotechnology	3	-	-	3	
BTB404	Database Management Systems	3	-	-	3	
BTB405	Chemical Biology	2	1	-	3	
BTB420	Biochemistry Lab - II	-	-	2	1	
BTB421	Genetics Lab	-	-	2	1	
BTB422	Methods & Instrumentation in Biotechnology Lab	-	-	2	1	
BTB423	Database Management Systems Lab	-	-	2	1	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BTB441	Professional Communication for Recruitment & Employability	30	-	-		
BTB443	Values & Ethics for Personal & Professional Development	30	-	-		
 BTB444 BTB445 BTB446 BTB447 BTB448	Foreign Language - IV French German Spanish Japanese Chinese	30		-		

SUMMER PROJECT I – (6 - 8 WEEKS)

FIFTH SEMESTER

Compulsory Courses:						
BTB501	Plant Biotechnology	3	-	-	3	
BTB502	Animal Biotechnology	3	-	-	3	
BTB503	Structural Biology	3	-	-	3	
BTB504	Chemical Engineering Principles	3	-	-	3	
BTB505	Basic Bioanalytical Techniques	3	-	-	3	
CSE 403	Java Programming	3	-	-	3	
BTB520	Plant Biotechnology Lab	-	-	2	1	
BTB521	Animal Biotechnology Lab	-	-	2	1	
BTB522	Structural Biology Lab	-	-	2	1	
CSE423	Java Programming Lab	-	-	4	2	
BTB560	Summer Project – I (Evaluation)	-	-	-	5	
	TOTAL				**28**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU541	Communication Skill - V	30	-	-	1	
BSU543	Behavioural Science - V	30	-	-	1	
 FLU544 GLU545 SLU546 JLU547 CLU548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-	2	

SIXTH SEMESTER

Compulsory Courses:						
BTB601	Recombinant DNA Technology	3	-	-	3	
BTB602	Enzymology & Enzyme Technology	3	-	-	3	
BTB603	Immunology & Immunotechnology	3	1	-	4	
BTB604	Computational Biology	3	-	-	3	
BTB605	Fundamentals of Biochemical Engineering	3	-	-	3	
BTB620	Recombinant DNA Technology Lab	-	-	2	1	
BTB621	Enzymology & Enzyme Technology Lab	-	-	2	1	
BTB622	Immunology & Immunotechnolgy Lab	-	-	2	1	
BTB623	Computational Biology Lab	-	-	2	1	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU641	Communication Skill - VI	30	-	-		
BSU643	Behavioural Science - VI	30	-	-		
 FLU644 GLU645 SLU646 JLU647 CLU648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT - II – (6 - 8 WEEKS)

SEVENTH SEMESTER

Compulsory Courses:						
BTB701	Bioprocess Technology	3	-	-	3	
BTB702	Downstream Processing	3	-	-	3	
BTB703	Statistics for Biology	3	-	-	3	
	Elective (Anyone of the following 8)	3	-	-	3	
BTB704	. Biosensors					
BTB705	Thermodynamics of Biological Systems					
BTB706	Pharmaceutical Chemistry & Drug Design					
BTB707	Current Topics in Biotechnology					
BTB708	Environmental Biotechnology					
BTB709	Bioprocess Plant Design					
BTB710	Artificial Neural Networks					
CSE504	Advanced Java Programming	3	-	-	3	
BTB720	Bioprocess Technology Lab	-	-	2	1	
BTB721	Downstream Processing Lab	-	-	2	1	
CSE524	Advanced Java Programming Lab	-	-	2	1	
BTB760	Summer Project - II (Evaluation)	-	-	-	6	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU741	Communication Skill - VII	30	-	-		
BSU743	Behavioural Science - VII	30	-	-		
	Foreign Language - VII	30	-	-		
FLU744	French – VII					
GLU745	German					
SLU746	Spanish					
JLU747	Japanese					
CLU748	Chinese					

EIGHTH SEMESTER

Compulsory Courses:						
BTB801	Genomic & Proteomics	3	-	-	3	
BTB802	Drug Delivery Systems	3	-	-	3	
BCH621	Management, Accounting & Cost Control	1	-	-	1	
BCH622	Project Management	1	-	-	1	
BCH623	Principles of Management & Enterprenurship Development	1	-	-	1	
CSE804	ASP.NET	3	-	-	3	
BTB820	Genomic & Proteomics Lab	-	-	2	1	
CSE824	ASP.NET	-	-	2	1	
BTB860	Major Project (10-12 Weeks)	-	-	-	16	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU841	Communication Skill - VIII	30	-	-	1	
BSU843	Behavioural Science - VIII	30	-	-	1	
	Foreign Language -VIII	30	-	-	2	
FLU844	French - VIII					
GLU845	German					
SLU846	Spanish					
JLU847	Japanese					
CLU848	Chines					

Curriculum & Scheme of Examination

APPLIED MATHEMATICS – I

Course Code: **BTB 101** **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Differential Calculus

Derivative of a function, Derivatives at a point, Fundamental rules for differentiation: Product Rule, Quotient Rule and Chain Rule, Differentiation of Implicit Functions, Parametric forms and Logarithmic Differentiation, Successive differentiation, Leibnitz's theorem (without proof), Mean value theorem, Taylor's and Maclaurin's Theorem, Asymptote & Curvature, Partial Differentiation, Euler's Theorem, Maxima and Minima

Module II: Integral Calculus

Fundamental Integral Formulae, Methods of Integration: Integration by Substitution, By Parts, Partial Fractions, Definite Integral and its Properties, Reduction Formulae, Application to length, Area and Volume.

Module III: Ordinary Differential Equations

Definition of Order and Degree of differential equation, Formation of ODEs, Solution of Differential Equation of 1st Order and 1st Degree: Variable Separation, Homogeneous Differential Equations, Linear Differential Equations, Exact Differential Equations, General Linear ODE of Second Order, Solution of Homogeneous Equation, Solution of Simple Simultaneous ODE

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Differential Calculus by Shanti Narain
Integral Calculus by Shanti Narain

References:

Differential Equation by A.R.Forsyth
Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - I (FIELDS AND WAVES)

Course Code: **BTB 102** **Credit Units: 03**

Course Objective:
Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I: Electrostatics
Brief introduction of Vectors, gradient of a scalar field, divergence and curl of vector field, Electric flux, Gauss's law, Statements of Gauss divergence and Stokes theorem

Module II: Relativity
Michelson-Morley experiment, Inertial & non-inertial frames, Special theory of Relativity, Relativistic space-time transformation, Transformation of velocity, Variation of mass with velocity, Mass-energy equivalence

Module III: Oscillations & Waves
Simple harmonic motion – equation and energy conservation, superposition of two SHMs, Lissajous figures, damped and forced oscillations – equations, amplitude and frequency response, LCR Circuit, resonance, sharpness of resonance, equation of motion for plane progressive waves, superposition of waves

Module IV: Wave Nature of Light
Interference: Conditions of interference, division of wavefront, Fresnel's biprism, division of amplitude, interference due to thin films, Newton's rings
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, Transmission grating and its resolving power.
Polarization: Birefringence, Nicol prism, Production and analysis of plane, circularly and elliptically polarized light, Half and quarter wave plates, Optical rotation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Waves & oscillation, A. P. French
Physics of waves, W. C. Elmore & M. A. Heald
Introduction to Electrodynamics, D. J. Griffith
Electrodynamics, Gupta, Kumar & Singh
Optics, A. K. Ghatak
Engineering Physics, Satya Prakash

APPLIED CHEMISTRY- I

Course Code: BTB 103 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Chemical Bonding
Types of bond: Ionic, Covalent and Co-ordinate bond; Fajan's rule; Hybridisation; H- bonding ; Valence bond and Molecular orbital theory for diatomic molecule.

Module II: Organic Mechanism
Electronegativity and dipole moment; Electron Displacement Effects: Inductive Effect; Mesomeric Effect; Electromeric Effects; Fission of covalent bonds; Intermediates of Organic reactions; Carbonium, Carbanion, Free Radical and Carbene; Types of organic reactions; Substitution, Elimination, Addition.

Module III: Instrumental method for Analysis
Introduction; Principles of spectroscopy; Law's of Absorbance; IR: Principle Instrumentation; Application; UV: Principle, Instrumentation and Application; NMR Principle and Instrumentation; Application; Chromatography; GC: Principle, Instrumentation and Application; HPLC: Principle, Instrumentation and Application.

Module IV: Thermodynamics
Introduction; Terminology; First Law; Heat Capacity; Calculation of thermodynamic quantities; Adiabatic and Isothermal Process; Reversible and Irreversible Process; Second law of Thermodynamics; Standard State; Gilbb's Helmholtz equation; VantHoff Isotherm and Isochore; Maxwell Relation; Third law of Thermodynamics; Chemical Potential; Activity and Activity Coefficient; Coupled Reactions.

Module V: Chemical Equilibrium
Introduction ; Le Chatelier's Principle; Equilibrium constant from Thermodynamic Constants; Acid-Base Concept; Weak acid and Weak base and their salts; Solubility Product; pH and pOH, Buffer Solution, Buffer Action.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
Engineering Chmistry, Jain & Jain
Engineering Chmistry, Shashi Chawla

References:

Organic Mechanism, Morrison and Boyd
Physical Chemistry, Puri Sharma and Pathania
Organic Chemistry Vol-I, IL Finar
Organic Chemistry Vol-II, IL Finar
Physical Chemistry, Atkins Peter, Paula Julio
A guide to mechanism in organic chemistry, Peter Sykes.
Introduction to practical chemistry, K.K.Sharma
Concise Inorganic chemistry, J.D. Lee

INTRODUCTION TO COMPUTERS

Course Code: **BTB 104** **Credit Units: 03**

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction

Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types), H/W concepts (I/O Devices), S/W concepts (System S/W & Application S/W, utilities). Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C

History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Precedence of Arithmetic operators, Operator precedence of Arithmetic Operators, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C

C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types(automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions

One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations. Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C

Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments.

Strings and C string library.

Structures and Unions. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments.

File Handling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Yashwant Kanetkar, “Let us C”, BPB Publications, 2nd Edition, 2001.
“ANSI C” by E Balagurusamy.
Herbert Schildt, “C: The complete reference”, Osbourne Mcgraw Hill, 4th Edition, 2002.
V.Raja Raman, “Computer Programming in C”, Prentice Hall of India, 1995.

***References*:**

Kernighan & Ritchie, “C Programming Language”, The (Ansi C Version), PHI, 2nd Edition.
J.B. Dixit, “Fundamentals of Computers and Programming in ‘C’.
P.K. Sinha and Priti Sinha, “Computer Fundamentals”, BPB publication.

LIFE SCIENCES-I

Course Code: **BTB 105** **Credit Units: 03**

Course Objective:

The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata and classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Invertebrates

Sailent features and outline classification of various phyla of invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II: Vertebrates

Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module-III: Lower Plants

Systematic: Recent trends in classification of Algae, Fungi, Bryophyte and Pteridophytes.
General account: Characteristic features; mode of reproduction and life cycles in Algae; Fungi including Lichens and Mycorrhiza; Bryophyte and Pteridophytes.
Economic Importance: Industrial applications; Ecological significance; Importance in agriculture.

Module-IV: Higher Plants

Systematics: Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority; Effective and valid publication; Author Citation. Broad outline of Bentham & Hooker, D.D Pant's classification
General account: General characteristic features, Distribution, mode of reproduction and generalised life cycles of Gymnosperms and Angiosperms.
Economic Importance: Industrial and ecological importance of Gymnosperms and Angiosperms

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Fundamentals of Environmental Chemistry, G.S.Sodhi, Narosa Publishers.
Introduction to Environmental Pollution, B.K Sharma, H.Kaur, Goel Publishers.
Biochemistry Styrier.
Cell Biology, C B Pawar.
Biochemistry, Lalinger.
Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain, Rastogi Publication.
Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.

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ENVIRONMENTAL STUDIES - I

Course Code: **BTB 106** **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance
Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem
Structure and function of an ecosystem
Producers, consumers and decomposers
Energy flow in the ecosystem
Ecological succession
Food chains, food webs and ecological pyramids
Introduction, types, characteristic features, structure and function of the following ecosystem:
Forest ecosystem
Grassland ecosystem
Desert ecosystem
Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels
India as a mega-diversity nation
Hot-spots of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
Endangered and endemic species of India
Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

APPLIED PHYSICS LAB - I

Course Code: BTB 120 **Credit Units: 01**

List of Experiments

To determine the wavelength of sodium light by Newtons's rings method.
To determine the dispersive power of the material of prism with the help of a spectrometer.
To determine the specific rotation of sugar by Bi-quartz or Laurent half shade polarimeter.
To determine the speed of ultrasonic waves in liquid by diffraction method.
To determine the width of a narrow slit using diffraction phenomena.
To determine the temperature coefficient of platinum wire, using a platinum resistance thermometer and a Callender & Grif/fth's bridge.
To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
To determine the internal resistance of Leclanche cell with the help of Potentiometer.
To determine the resistance per unit length of a Carey Foster's bridge wire and also to find out the specific resistance of a given wire.
To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.
To determine the value of acceleration due to gravity ("g") in the laboratory using bar pendulum.
To determine the moment of inertia of a flywheel about its own axis of rotation.
To determine the density of material of the given wire with the help of sonometer

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - I

Course Code: BTB 121 **Credit Units: 01**

List of Experiments

Titration of phosphoric acid and sodium hydroxide solution using pH meter.
Verification and application of Beer's Law.
Spectroscopic analysis of iron in water sample.
Conductometric titration.
Determination of water modules of crystallization in Mohr's salt.
(A) Determination of surface Tension of liquid.
(B) Application of surface tension method in mixture analysis.
Application of distribution law in the determination of equilibrium constant.
Analysis of iron ore.
Plant pigments separation by paper chromatography.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PROGRAMMING IN C LAB

Course Code: **BTB 122** **Credit Units: 01**

Software Required: Turbo C

Course Contents:

Module I

DOS commands

Module II

Creation of batch files

Module III

C program involving problems like finding the nth value of cosine series, Fibonacci series etc.

Module IV

C programs including user defined function calls

Module V

C programs involving pointers, and solving various problems with the help of those.

Module VI

File handling

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENGINEERING GRAPHICS LAB

Course Code: **BTB 123** **Credit Units: 01**

Course Objective:

This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines

Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures

Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids

Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI: Development of Surface

Development of simple objects with and without sectioning. Isometric Projection

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

M.B. Shah & B.C. Rana, Engineering Drawing, Pearson Education, 2007

PS Gill, Engineering Drawing, Kataria Publication

ND Bhatt, Engineering Drawing, Charotar publications

N Sidheshwar, Engineering Drawing, Tata McGraw Hill

CL tanta, Mechanical Drawing, “Dhanpat Rai”

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: **BTB 141** **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

Madhulika Jha, Echoes, Orient Long Man
Ramon & Prakash, Business Communication, Oxford.
Sydney Greenbaum Oxford English Grammar, Oxford.
Successful Communications, Malra Treece (Allyn and Bacon)
Effective Technical Communication, M. Ashraf Rizvi.

*** 30 hrs Programme to be continued for Full year**

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: BTB 143 Credit Units: 01

Course Objective:

This course aims at imparting:
Understanding self & process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effective on personality
Building Emotional Competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning and Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and nature of attitude
Components and Types of attitude
Importance and relevance of attitude

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, components, Importance and Relevance
Positive and Negative emotions
Healthy and Unhealthy expression of emotions

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

Organizational Behaviour, Davis, K.

Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers

Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books

Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour

Dressler, David and Cans, Donald: The Study of Human Interaction

Lapiere, Richard. T – Social Change

Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.

Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.

LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi

J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company

Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - I

Course Code: BTB 144 **Credit Units: 02**

Course Objective:

To familiarize the students with the French language
with the phonetic system
with the syntax
with the manners
with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)
se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
dire/interroger si on comprend
Nommer les choses

Unité 2: Faire connaissance
donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps
dire la date et l'heure

Contenu grammatical:
1. organisation générale de la grammaire
article indéfini, défini, contracté
nom, adjectif, masculin, féminin, singulier et pluriel
négation avec « de », "moi aussi", "moi non plus"
interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
Interro-négatif : réponses : oui, si, non
pronom tonique/disjoint- pour insister après une préposition
futur proche

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

le livre à suivre : Campus: Tome 1

APPLIED MATHEMATICS – II

Course Code: **BTB 201** **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from athematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Linear Algebra

Definition of a Matrix, Operations on Matrices Determinants, Elementary Operations, Reduction of a Matrix to Row Echelon Form, Rank of a Matrix, Consistency of Linear Simultaneous Equations, Gauss Elimination and Gauss Jordan – Method, Eigen values and Eigen Vectors of Matrix, Caley-Hamilton theorem, Diagonalization of a matrix.

Module II: Complex Number

Definition of Complex Number, Equality, Conjugate and Modulus of a Complex Number, Polar form of a Complex Number, De-Moivre's Theorem, Roots of a Complex Number, Exponential and Circular function of a Complex Number, Hyperbolic Functions and their inverses.

Module III: Vector Calculus

Scalar and vector field, Gradient, Divergence and Curl, Directional Derivative, Evaluation of a Line Integral, Green's theorem in plain (without proof), Stoke's theorem (without proof) and Gauss Divergence theorem (without proof)

Module IV: Probability and Statistics

Frequency Distribution, Arithmetic Mean, Median, Partition Values, Mode, Variance and Standard Deviation, Curve Fitting, Principle of least squares, Linear regression.

Introduction to Probability, Addition and Multiplication theorem of Probability, Random variables and Probability Distribution,Expected values, Binomial distribution, Poisson distribution and Normal.

Distribution and their Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - II

Course Code: **BTB 202** **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering.

Course Contents:

Module I: Wave Mechanics

de-Broglie matter waves, wave nature of particles, phase and group velocity, Heisenberg uncertainty principle, wave function and its physics interpretation, Operators, expectation values. Time dependent & time independent SchrÖdinger wave equation for free & bound states, square well potential (rigid wall), Concept of step potential.

Module II: Atomic Physics

Vector atom model, LS and j-j coupling, Zeeman effect & Paschen-Back effect, Bragg's law, X-ray spectra and energy level diagram, Laser – Einstein coefficient, population inversion, condition of light amplification, He-Ne and Ruby laser

Module III: Solid State Physics

Sommerfield's free electron theory of metals, Fermi energy, Energy bands in solids, physics of semi-conductors, doping, intrinsic and extrinsic semiconductors, Depletion layer, characteristics of PN junction, Forward and reverse baising, Breakdown voltage, Superconductivity, Meissner effect, Introduction to Nanomaterials

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Concept of Modern Physics, A. Beiser
Applied Physics II, Agarawal & Goel
Solid State Physics, S. O. Pallai
Physics of Atom, Wehr & Richards

APPLIED CHEMISTRY - II

Course Code: BTB 203 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Water

Hardness of Water; Boiler Feed Water; Scale and Sludge; Softening of Water; External and Internal Treatment of Boiler Water; Domestic Water Treatment; Domestic Water Treatment; Desalination of Brackish Water; Chemical Analysis of Water; Dissolved O_2 (BOD, COD); Estimation of Free Chlorine; TDS.

Module II: Lubricants

Introduction; Mechanism of Lubrication; Types of Lubricants; Chemical structure related to Lubrication; Properties of lubricants; Viscosity and Viscosity Index; Iodine Value; Aniline Point; Emulsion number; Flash Point; Fire Point; Drop Point; Cloud Point; Pour Point. Selection of Lubricants.

Module III: Fuel

Introduction; Characteristics of good Fuel ; Calorific value; Bomb Calorimeter; Proximate and Ultimate analysis of coal; Carbonization of coal; Gasification and Liquification of coal: Fischer Tropsch and Bergius Process; Water Gas and Producer Gas

Module IV: Polymers

Introduction; Polymerization: Addition and Condensation Polymerization; Thermosetting and Thermoplastic Polymers; Molecular Weight of Polymer; Rubber, Plastic and Fiber; Preparation, Properties and uses of PMMA, Polyester, Epoxy Resins and Bakelite, Silicone Polymers.

Module V: Corrosion

Introduction, Mechanism of Dry and Wet Corrosion, Types of Corrosion, Galvanic Corrosion, Concentration Cell Corrosion, Passivity, Underground Soil Corrosion, Pitting Corrosion, Intergranular Corrosion, Waterline Influencing Corrosion, Corrosion Control.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Engineering Chemistry-Jain & Jain
Engineering Chemistry- Shashi Chawla

References:

Engineering Chemistry -Dara
Engineering Chemistry -Sunita Ratan
Polymer Science - Gowariker, Viswanathan Sreedhar
Corrosion Engineering – Fontenna and Greene

OBJECT ORIENTED PROGRAMMING IN C++

Course Code: **BTB 204** **Credit Units: 03**

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Course Contents:

Module I: Introduction
Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module II: Classes and Objects
Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module III: Inheritance
Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hiérarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module IV: Polymorphism
Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module V: Strings, Files and Exception Handling
Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

A.R.Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH, 1997
R. Lafore, “Object Oriented Programming using C++”, BPB Publications, 2004.
“Object Oriented Programming with C++” By E. Balagurusamy.
Schildt Herbert, “C++: The Complete Reference”, Wiley DreamTech, 2005.

References:

Parasons, “Object Oriented Programming with C++”, BPB Publication, 1999.
Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication, 2002.
Yashwant Kanethkar, “Object Oriented Programming using C++”, BPB, 2004

ELECTRICAL SCIENCE

Course Code: **BTB 205** **Credit Units: 02**

Course Objective:

The objective of the course is to provide a brief knowledge of Electrical Engineering to students of all disciplines. This Course includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of Transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Course Contents:

Module I: Basic Electrical Quantities

Basic Electrical definitions-Energy, Power, Charge, Current, Voltage, Electric Field Strength, Magnetic Flux Density, etc., Resistance, Inductance and Capacitance. Ideal Source, Independent Source and Controlled Source

Module II: Network Analysis Techniques & Theorems

Circuit Principles: Ohm's Law, Kirchoff's Current Law, Kirchoff's Voltage Law Network Reduction: Star–Delta Transformation, Source Transformation, Nodal Analysis, Loop analysis. Superposition theorem, Thevenin's Theorem, Norton's theorem and Reciprocity theorem.

Module III: Alternating Current Circuits

Peak, Average and RMS values for alternating currents, Power calculation: reactive power, active power, Complex power, power factor, impedance, reactance, conductance, susceptance Resonance: series Resonance, parallel resonance, basic definition of Q factor & Band-width.

Module IV: Transformers

Basic Transformer Operation principle, Construction, Voltage relations, current relations, Linear circuit models, open circuit test, short circuit test, Transformer Efficiency.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

R.J. Smith, R.C. Dorf: Circuits, devices and Systems
B.L. Thareja: Electrical Technology : Part -1 & 2
V.Deltoro: Electrical Engineering fundamentals
Schaum's Series: Electrical Circuits

LIFE SCIENCES - II

Course Code: BTB 206 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. Moreover paper will provide knowledge of various physiological activities of higher plants which will help them to understand the various profiles of modern biotechnology.

Course Contents:

Module I: Anatomy & Physiology of Rabbit.

Integumentary system
Skeletal System: Girdles only
Digestive system
Respiratory System

Module II: Anatomy & Physiology of Rabbit.

Circulatory System: Heart and Aortic Arches only
Nervous System; Brain only
Endocrine System
Urinogenital System

Module-III

Module-III Plant Physiology-I

Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration.

Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation; Plant Hormones.

Module-IV Plant Physiology-II

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

Respiration: Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.

Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.

Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York

Shier, D., Butler, J. and Lewis, R., Hole"s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.

Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.

Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

Ecology & Environment, P.D. Sharma, Rastogi Publications.

Anatomy of Seed Plants, K. Esau, John Wiley & Sons.

An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.

Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.

ENVIRONMENTAL STUDIES - II

Course Code: **BTB 207** **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

Air pollution
Water pollution
Soil pollution
Marine pollution
Noise pollution
Thermal pollution
Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

APPLIED PHYSICS LAB - II

Course Code: **BTB 220** **Credit Units: 01**

List of Experiments

1. To determine the wavelength of prominent lines of mercury spectrum using plane transmission grating.
2. To determine the thickness of a given wire by Wedge method.
3. To determine the wavelength of He-Ne laser light using single slit.
4. To determine the frequency of an electrically maintained tunning fork by Melde's method.
5. To study the variation of magnetic field along the axis of Helmholtz coil and to find out reduction factor.
6. To draw the V – I characteristics of a forward and reverse bias PN junction diode.
7. To determine the frequency of AC mains using sonometer.
8. To determine the energy band-gap of Germanium crystal using four probes method.
9. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
10. To determine the acceleration due to gravity ("g") using Keter's reversible pendulum.
11. To study the characteristics of photo voltaic cell (Solar cell).

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - II

Course Code: **BTB 221** **Credit Units: 01**

Course Contents:

Determining the viscosity index of lubricating oil by using Redwood viscometer.
Determining the flash point and fire point of lubricating oil.
Determination of Hardness of Water.
Chemical Analysis of Water like Alkalinity, residual Chlorine.
Synthesis of Urea Formaldehyde resin.
Determination of Molecular weight of Polymer.
Determination of Ion exchange capacity of a region.
Determination of dissolved Oxygen in Water.
Determination of Iodine value in water.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

OBJECT ORIENTED PROGRAMMING IN C++ LAB

Course Code: **BTB 222** **Credit Units: 01**

Software Required: Turbo C++

Creation of objects in programs and solving problems through them.
Different use of private, public member variables and functions and friend functions.
Use of constructors and destructors.
Operator overloading
Use of inheritance in and accessing objects of different derived classes.
Polymorphism and virtual functions (using pointers).
File handling.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ELECTRICAL SCIENCE LAB

Course Code: **BTB 223** **Credit Units: 01**

List of Experiments

To verify KVL & KCL in the given network.
To verify Superposition Theorem.
To verify Maximum Power Transfer Theorem.
To verify Reciprocity Theorem.
To determine and verify RTh, VTh , RN , IN in a given network.
To perform open circuit & short circuit test on a single-phase transformer.
To study transient response of a given RLC Circuit.
To perform regulation, ratio & polarity test on a single-phase transformer.
To measure power & power factor in a three phase circuit by two wattmeter method.
To measure power & power factor in a three phase load using three ammeters & three voltmeter method.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: **BTB 241** **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

Madhulika Jha, Echoes, Orient Long Man
Ramon & Prakash, Business Communication, Oxford.
Sydney Greenbaum Oxford English Grammar, Oxford.
Successful Communications, Malra Treece (Allyn and Bacon)
Effective Technical Communication, M. Ashraf Rizvi.

INDIVIDUAL, SOCIETY AND NATION

Course Code: **BTB 243** **Credit Units: 01**

Course Objective:

To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking
Thinking skills
Module II: Hindrances to Problem Solving Process
Perception
Expression
Emotion
Intellect
Work environment
Module III: Problem Solving
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation
Barriers to problem solving:
Perception
Expression
Emotion
Intellect
Work environment **Module**
IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome
Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
Convergent and Divergent thinking
Idea generation and evaluation (Brain Storming)
Image generation and evaluation
Debating
The six-phase model of Creative Thinking: ICEDIP model
Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: **BTB 244** **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.

To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue

rédiger un message/ une lettre pour …

prendre un rendez-vous/ accepter et confirmer/ annuler

inviter/accepter/refuser

Faire un programme d'activités

imaginer une conversation téléphonique/un dialogue

Propositions- interroger, répondre

Unité 4: **Découvrir son environnement**

situer un lieu

s'orienter, s'informer sur un itinéraire.

Chercher, décrire un logement

connaître les rythmes de la vie

Unité 5 : s'informer

demander/donner des informations sur un emploi du temps passé.

donner une explication, exprimer le doute ou la certitude.

découvrir les relations entre les mots

savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs

Adjectifs possessifs/exprimer la possession à l'aide de :

i. « de » ii. A+nom/pronom disjoint

Conjugaison pronominale – négative, interrogative - construction à l'infinitif

Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »

passé composé

Questions directes/indirectes

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

CELL BIOLOGY

Course Code: BTB 301 Credit Units: 03

Course Objective:
Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. It incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The object of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Course Contents:

Module I
The cell theory, pre cellular evolution, prokaryotic and eukaryotic cells.

Module II
Cell cycle - molecular events, cell division, mitosis and meiosis.

Module III
Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus, lysosomes, peroxisomes, golgi bodies, and transport across membranes.

Module IV
Cell locomotion- cytoskeleton, structure and function of cilia and flagella.

Module V
Cellular signaling –general mechanism of signaling and structures of the various types of receptors.

Module VI
Types of cancer, etiology of cancer, metastasis, cytological role of p53 and p21 genes in cancer development.

Module VII
Apoptosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.

References:
- Cell in Development and Inheritance, E.B. Wilson, Macmilian
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.

BIOCHEMISTRY - I

Course Code: BTB 302 Credit Units: 03

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I
Introduction aims and scope
Chemical foundations of Biology -Properties of water, acids, bases and buffers, covalent bonds, Non-covalent interactions in biological systems.

Module II
Introduction to biomolecules - *Carbohydrates* -Sugars; Polysaccharides
Lipids -classification, structure and function. Lipids and biological membranes, Lipid linked proteins and lipoproteins.

Module III
Metabolism and bioenergetics -First and second law, free energy and chemical equilibrium, Organic reaction mechanisms, Design of metabolism-concept of free energy, ATP-ADP cycle. Cellular energy transactions -role of mitochondria and chloroplast

Module IV
Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle - Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondrion and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module V
Lipid metabolism - Lipid digestion, absorption and transport, fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism. Cholesterol and Arachidonic Acid metabolism, Phospholipids, Sphingolipids and Glycolipids

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

MICROBIOLOGY

Course Code: BTB 303 Credit Units: 03

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I

Introduction and historical perspective - Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques.

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms - photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship - Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

MOLECULAR BIOLOGY

Course Code: **BTB 304** **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Course Contents:

Module I: DNA Replication and repair
Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication, DNA repair Mechanism.

Module II: Transcription
Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.

Module III: Modifications in RNA
5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

Module IV: Translation
Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.

Module V: Regulation of Gene Expression in prokaryotic and eukaryotic systems
Lac operon, Ara operan, regulation in Eukaryotes

Module VI: Antisense and Ribozyme technology
Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of Ribozyme; Hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense and ribozyme technologies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing
- Gene VIII, Benjamin Lewin 2005, Oxford University Press

References:

- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.

DATA STRUCTURE AND ALGORITHMS

Course Code: **BTB 305** **Credit Units: 03**

Course Objective:

It helps the students to utilize the information acquired through electronic media to access biological information network and data bases in order to understand biological functions and then to evaluate genetic diseases, their causes and risks related to human kind.

Course Contents:

Module I: Introduction

Module II: Programming strategies
Objects and ADTs with example, Constructors and destructors, Data structure, methods, Pre and post conditions, C conventions, Error handling, Some programming language notes.

Module III: Data structures
Arrays; lists; stacks and stack frames; Recursion -Recursive functions with example of factorial, Queue, Degeue.

Module IV: Searching
Sequential and binary search, Trees, binary search tree, complexity.

Module V: Queues
Priority queues and heaps

Module VI: Sorting
Bubble, Heap, Quick, Bin, Radix

Module VII: Searching revisited
Red-Black trees, AVL trees, general n-ary trees, hash tables; Hashing and collision resolution

Module VIII: Dynamic algorithm
Fibonacci numbers, bionomial coefficients, optimal binary search trees, matrix chain multiplication, longest common subsequence, optimal triangulation.

Module IX: Graphs
Minimum spanning tree and Djkstra’s algorithm

Module X: Huffman encoding, FFT, Hard or intractable problems
Eulerian or Hamiltonian paths, Travelling salesman problem.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Data Structures and Algorithms, A.V. Aho, J.E. Hopcroft and J. Ullman, Addison-Wesley Publishing
- Database Design, Development and Deployment with Student CD, P. Rob and E. Semaan, McGraw-Hill/Irwin
- Schaum’s Outline of Data Structures with C++, J.R. Hubbard, McGraw Hill Trade.

References:
- Database system concepts, A. Silberschatz, P.B. Galvin and G. Gagne, John Wiley and Sons Inc.
- Introduction to Data Structures and Application, J. Tremblay and P.G. Sorensen, McGraw Hill College Division

CELL BIOLOGY LAB

Course Code: BTB 320 Credit Units: 01

Course Contents:

Module I
Microscopy: Light microscopy, Bright field, Phase contrast

Module II
Study of chromoplasts, chloroplast in plant cell.

Module III: Cell Division
Mitosis and Meiosis

Module IV
Study of permanent slides of types of cancer

Module V
Study of apoptosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOCHEMISTRY LAB - I

Course Code: BTB 321 Credit Units: 01

Course Contents:

Module I
Colorimetric determination of pK.

Module II
Colour reactions of sugars. (Molischs test, iodine test, Saliwanoff test, Fehlings test, Benedicts test, Bials test).
Quantitative test for Carbohydrate & Protein.

Module III
Cholestrol estimation
Estimation of free fatty acids
Estimation of iodine number.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MICROBIOLOGY LAB

Course Code: BTB 322 **Credit Units: 01**

Course Contents:

Preparation of solid and liquid media.
Isolation and maintenance of organisms by plating, streaking and serial dilution.
Preparation of slant cultures.
Growth curve measurement of bacterial population by turbidometry.
Measurement of bacterial population by dilution method.
Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.
Microscopic examination of bacteria by gram staining.
Endospore staining.
Capsule staining.
Isolation and identification of Rhizobium from root nodules.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MOLECULAR BIOLOGY LAB

Course Code: BTB 323 **Credit Units: 01**

Course Contents:

Module I
Preparation of DNA: genomic, Plasmid
Module II
Isolation of RNA
Module III
RFLP analysis
Module IV
Gel filtration
Module V
Preparation of Competent Cells
Module VI
Restriction Digestion and Ligation of DNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATA STRUCTURE LAB

Course Code: **BTB 324** **Credit Units: 01**

Course Contents:

Module I
Stack implementation through arrays, link list

Module II
Programs for recursion functions

Module III
Implementation of queues and leap structures

Module IV
Application of binary trees in pre-order, post-order and in-order evaluation

Module V
A VL tree implementation

Module VI
Optimal matrix multiplication

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

EFFECTIVE WRITTEN COMMUNICATION

Course Code: **BTB 341** **Credit Units: 01**

Course Objective:

To form written communication strategies necessary in the workplace.

Course Contents:

Module I: Introduction to Writing Skills
Effective Writing Skills
Avoiding Common Errors
Paragraph Writing
Note Taking
Writing Assignments

Module II: Letter Writing
Types
Formats

Module III
Memo
Agenda and Minutes
Notice and Circulars

Module IV: Report Writing
Purpose and Scope of a Report
Fundamental Principles of Report Writing
Project Report Writing
Summer Internship Reports

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

Business Communication, Raman –Prakash, Oxford
Creative English for Communication, Krishnaswamy N, Macmillan
Textbook of Business Communication, Ramaswami S, Macmillan
Working in English, Jones, Cambridge
A Writer's Workbook Fourth edition, Smoke, Cambridge
Effective Writing, Withrow, Cambridge
Writing Skills, Coe/Rycroft/Ernest, Cambridge
Welcome!, Jones, Cambridge

PROBLEM SOLVING & CREATIVE THINKING

Course Code: BTB 343 **Credit Units: 01**

Course Objective:

This course provides practical guidance on:
Enhancing personal effectiveness and performance through effective interpersonal communication
Enhancing their conflict management and negotiation skills

Course Contents:

Module I: Interpersonal Communication: An Introduction
Importance of Interpersonal Communication
Types – Self and Other Oriented
Rapport Building – NLP, Communication Mode
Steps to improve Interpersonal Communication

Module II: Behavioural Communication
Meaning and Nature of behavioiural communication
Persuasion, Influence, Listening and Questioning
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication for personal and professional development

Module III: Interpersonal Styles
Transactional Analysis
Life Position/Script Analysis
Games Analysis
Interactional and Transactional Styles

Module IV: Conflict Management
Meaning and nature of conflicts
Styles and techniques of conflict management
Conflict management and interpersonal communication

Module V: Negotiation Skills
Meaning and Negotiation approaches (Traditional and Contemporary)
Process and strategies of negotiations
Negotiation and interpersonal communication

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
Julia T. Wood. Interpersonal Communication everyday encounter
Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel
Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
Harvard Business School, Effective Communication: United States of America
Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - III

Course Code: BTB 344 Credit Units: 02

Course Objective:

To provide the students with the know-how
To master the current social communication skills in oral and in written.
To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
caractériser une personne (aspect physique et caractère)

Contenu grammatical:

accord des adjectifs qualificatifs
articles partitifs
Négations avec de, ne…rien/personne/plus
Questions avec combien, quel…
expressions de la quantité
ne…plus/toujours - encore
pronoms compléments directs et indirects
accord du participe passé (auxiliaire « avoir ») avec l'objet direct
Impératif avec un pronom complément direct ou indirect
construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

le livre à suivre : Campus: Tome 1

TERM PAPER

Course Code: BTB 330 Credit Units: 02

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.
The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

Choosing a Subject

The subject chosen should not be too general.

Finding Sources of materials

The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
Begin by making a list of subject-headings under which you might expect the subject to be listed.
The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.
Get facts, not just opinions. Compare the facts with author's conclusion.
In research studies, notice the methods and procedures, results & conclusions.
Check cross references.

Outlining the paper

Review notes to find main sub-divisions of the subject.
Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:
statement of purpose
main body of the paper
statement of summary and conclusion
Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

Editing & Preparing the final Paper

Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
Read the paper to ensure that the language is not awkward, and that it "flows" properly.
Check for proper spelling, phrasing and sentence construction.
Check for proper form on footnotes, quotes, and punctuation.
Check to see that quotations serve one of the following purposes:
  Show evidence of what an author has said.
  Avoid misrepresentation through restatement.
  Save unnecessary writing when ideas have been well expressed by the original author.
Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

Title page
Acknowledgement
Abstract
Table of contents
Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?

Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?

Results (If any)

Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research

References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

File Specifications: The file should be submitted in plastic folder with following specifications:

A4 size paper
Font: Arial(10 pts) or Times New Roman(12pts)
Line Spacing(1.5)
Top & Bottom Margins 1 inch/2.5 cm
Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOCHEMISTRY - II

Course Code: **BTB 401** **Credit Units: 04**

Course Objective:
The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I
Proteins - Amino acids and peptides - classification, chemical reactions and physical properties. Introduction to protein structure and function. Glycoproteins -structure and function, *Vitamins and Coenzymes*: structure and function of water soluble vitamins.
Enzymes - Introduction to kinetic and catalytic mechanisms of enzymes; Regulation of enzyme activity; Effects of physical parameters on enzyme activity, enzyme inhibitors – types of inhibition.

Module II
Nucleic acids - nitrogenous bases, nucleotides, types, structure and properties of nucleic acids

Module III
Amino acid metabolism - Amino acid deamination, urea cycle, biosynthesis and breakdown of nutritionally non-essential amino acids (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine. Specialized Products of Amino Acids, Nitrogen fixation

Module IV
Nucleotide Metabolism -structure and metabolism of purines and pyrimidines, biosynthesis of nucleotide coenzymes (NAD, NADP, FAD, FMN; Catabolism of heam and clinical significance of bilirubin.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
Biochemistry, L. Stryer, W.H. Freeman and Company
Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:
Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

GENETICS

Course Code: BTB 402 Credit Units: 04

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.

Course Contents:

Module I

The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.

Module II: Mendelism

Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture.

Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.

Module III

Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.

Module IV

Mutation and mutagenic agents, types of mutations, economic importance of mutation

Module V

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage

Module VI: Genetics of Population

Hardy- Weinburg Law and its deviations.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Genetics, P.K. Gupta, Rastogi Publication

Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

Genetics, M.W. Strickberger, Prentice Hall College Division

Genetics, P.J.Russell, Benjamin/Cummings

Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

Genetics, R. Goodenough, International Thomson Publishing

Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company

Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.

Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: **BTB 403** **Credit Units: 03**

Course Objective:
The students will be exposed to techniques and instruments that are used in biotech industries.

Course Contents:

Module I: Electrophoresis
Agrose Gel electrophoresis, PAGE, SDS-PAGE, isoelectric focusing, two-dimensional electrophoresis, immuno electrophoresis, capillary electrophoresis

Module II: Chromatography
Paper, TLC, gel filtration, ion-exchange chromatography, affinity chromatography, HPLC and GLC

Module III: Spectroscopy
UV and visible spectroscopy ,Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Mass Spectrometry, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy,

Module IV
ray diffraction and X-ray Crystallography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:
Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
Crystallography made Crystal Clear, G. Rhodes, Academic Press
Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wi

DATABASE MANAGEMENT SYSTEMS

Course Code: **BTB 404** **Credit Units: 03**

Course Objective:

It enables the students to access biological information networks and databases in order to understand the different techniques of biotechnology to build detection systems especially in the prevention and treatment of human diseases.

Course Contents:

Module I: Overview and historical perspective
File systems vs. DBMS, advantages of DBMS;

Module II: Describing and storing data in DBMS
Levels of abstraction and data independence; Data models and their comparison; Entity relationship model - concepts, design, keys and features; Relational model -introduction, structure of the relational databases, integrity constraints, Relational algebra and calculus -selection and projection, set operations, renaming, Joins, Division etc.

Module III: SQL and Perl

Module IV: Database design
Functional dependencies, Normal forms; Concurrency control and database discovery -concept of transaction: atomicity, consistency, isolation and durability, transactions and schedules, concurrent execution of transactions, Lock based concurrency control, Database recovery

Module V: Current trends
Distributed databases and multimedia databases;

Module VI: Data warehousing and Data Mining

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Data Mining: Concept and techniques, J. Han and M. Kamber, Morgan Kaufman.
Data Mining, A.K. Pujari, Sangam Books Ltd.
Database Management, P.C. Desai.
Introduction to Database Systems, C.J. Date, Addison Wesley Publishing.

References:
Principles of Database and Knowledge Based systems, J.D. Ullman, Computer Science Press.
The Data Warehouse Lifecycle Toolkit, John Wiley and Sons Inc.
The Data Warehouse Toolkit, R. Kimball et al, John Wiley and Sons Inc.

CHEMICAL BIOLOGY

Course Code: **BTB 405** **Credit Units: 03**

Course Objective:

Chemical biology is that branch of life science, which deals with the study and manipulation of biological systems through the application of chemical techniques and tools. It differs from the more traditional disciplines of chemistry and biology in its emphasis on integrating a wider series of experimental techniques, ranging from synthetic organic chemistry, to biochemistry, to structural, molecular, and cellular biology. Chemical biology has historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry and metabolic engineering.

Course Contents:

Module I: Principles of chemical biology
Chemistry of carbohydrates, proteins and nucleic acids, strategies for identifying the cellular target of physiologically active natural products (paclitaxel, vancomycin), chemical aspects of signal transduction

Module II: Chemical reactions in living systems
Introduction to enzyme chemistry, Group transfer reactions, Substitutions, Carboxylation and decarboxylation, Isomerases, Eliminations and additions, Redox reactions (1), Redox reactions (2), Aldol and Claisen Reactions, One-carbon transfer reactions, Rearrangements

Module III: Structural chemical biology
Purine biosynthesis, polyamide biosynthesis, thiamine biosynthesis, vitamin E biosynthesis, proteases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Chemical Biology by H. Gobind Khorana
Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH
Foundations of Chemical Biology, C.M. Dobson, J.A. Gerrard, A.J. Pratt, Oxford Chemistry Primers
Innovations in Chemical Biology, Sener Bilge, Springer
Chemical biology by Stuart L. Shreiber, Tarun Kapoor, Gunther Wess, Wiley-VCH.

References:
A General Method for Discovering Inhibitors of Protein−DNA Interactions Using Photonic Crystal Biosensors *Chem. Biol.*, 2008, *3* (7), pp 437–448.
Optimization of non-natural nucleotides for selective incorporation opposite damaged DNA Org. Biomol. Chem., 2007, 5, 3623 – 3630.

BIOCHEMISTRY LAB - II

Course Code: **BTB 420** **Credit Units: 01**

Course Contents:

Module I
Colour reactions of proteins (Ninhydrin test, Biuret test, Xanthoprotein test).
Estimation of proteins.

Module II
Biochemical estimation of DNA
Biochemical estimation of RNA
Quantitative determination of DNA and RNA by spectrophotometric method using UV range.
Determination of melting temperature of DNA from thermal denaturation characteristics.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS LAB

Course Code: **BTB 421** **Credit Units: 01**

Course Contents:

Study of gene interaction.
Study of chromosomal translocation in Rhoeo discolor.
Study of bacterial conjugation.
Study of bacterial transduction.
Study of physical and chemical mutagens on growth of E. coli.
PTC test.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: BTB 422 **Credit Units: 01**

Course Contents:

Module I
Cell disruption techniques

Module II
Centrifugation – low speed and high speed.

Module III
Spectrophotometer techniques

Module IV
Chromatography –Paper Chromatography and Thin Layer Chromatography

Module V
Electrophoresis –SDS Page and Agarose gel electrophoresis.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATABASE MANAGEMENT SYSTEMS LAB

Course Code: BTB 423 **Credit Units: 01**

Course Contents:

Module I
Database creation using DDL and DML.
Module II
Defining the primary and secondary keys.
Module III
Implementation of selection, projection and joins (internal and external) with SQL and Perl.
Module IV
Normalization of databases with SQL and Perl
Module V
Implementation of transactions and schedules.

Module VI
Detection of association rules and knowledge recovery.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PROFESSIONAL COMMUNICATION FOR RECRUITMENT & EMPLOYABILITY

Course Code : **BTB 441** **Credit Units: 01**

Course Objective:

To teach the participants strategies for improving academic reading and writing.
Emphasis is placed on increasing fluency, deepening vocabulary, and refining academic language proficiency.

Course Contents:

Module I: Social Communication Skills
Small Talk
Conversational English
Appropriateness
Building rapport

Module II: Context Based Speaking
In general situations
In specific professional situations
Discussion and associated vocabulary
Simulations/Role Play

Module III: Professional Skills
Presentations
Negotiations
Meetings
Telephony Skills

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

Essential Telephoning in English, Garside/Garside, Cambridge
Working in English, Jones, Cambridge
Business Communication, Raman –Prakash, Oxford
Speaking Personally, Porter-Ladousse, Cambridge
Speaking Effectively, Jermy Comfort, et.al, Cambridge
Business Communication, Raman –Prakash, Oxford

VALUES & ETHICS FOR PERSONAL & PROFESSIONAL DEVELOPMENT

Course Code : BTB 443 **Credit Units: 01**

Course Objective:

To understand the basis of interpersonal relationship.
To understand various communication style.
To learn the strategies for effective interpersonal relationship.

Course Contents:

Module I: Understanding Relationships
Importance of relationships
Role and relationships
Maintaining healthy relationships

Module II: Bridging Individual Differences
Understanding individual differences
Bridging differences in Interpersonal Relationship – TA
Communication Styles

Module III: Interpersonal Relationship Development
Importance of Interpersonal Relationships
Interpersonal Relationships Skills
Types of Interpersonal Relationships

Module IV: Theories of Interpersonal Relationships
Theories: Social Exchange, Uncertainty Reduction Theory
Factors Affecting Interpersonal Relationships
Improving Interpersonal Relationships

Module V: Impression Management
Meaning & Components of Impression Management
Impression Management Techniques (Influencing Skills)
Impression Management Training-Self help and Formal approaches

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	**SAP**	**A**	**Mid Term Test (CT)**	**VIVA**	**Journal for Success (JOS)**
Weightage (%)	20	05	20	30	25

Text & References:

Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
Julia T. Wood. Interpersonal Communication everyday encounter
Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
Harvard Business School, Effective Communication: United States of America
Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - IV

Course Code: **BTB 444** **Credit Units: 02**

Course Objective:

To enable students:
To develop strategies of comprehension of texts of different origin
To present facts, projects, plans with precision

Course Contents:

Module C: pp. 104 – 139: Unités 8, 9

Contenu lexical: **Unité 8: Découvrir le passé**

parler du passé, des habitudes et des changements.
parler de la famille, raconter une suite d'événements/préciser leur date et leur durée.
connaître quelques moments de l'histoire

Unité 9: Entreprendre

faire un projet de la réalisation: (exprimer un besoin, préciser les étapes d'une réalisation)
parler d'une entreprise
parler du futur

Contenu grammatical:

1. Imparfait

Pronom « en »
Futur
Discours rapporté au présent
Passé récent
Présent progressif

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

le livre à suivre : Campus: Tome 1

PLANT BIOTECHNOLOGY

Course Code: BTB 501 **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I
Historical perspective of plant tissue culture.
Tissue culture lab and organization
Sterilisation techniques
Types of nutrient media and media composition
Plant regeneration pathways
Role of phytohormones
Cell culture techniques- cell, tissue, organ cultures, callus culture, suspension culture
Culture techniques Callus culture, cell culture and protoplast cultures.

Module II
Organogenesis and somatic embryogenesis.
Applications of plant tissue and cell culture.
Micropopogation, pathogen free plants. production haploids,
Somaclonal variation.preservation of germplasm.

Module III
Genetic engineering in plants, - transformation vectors
Gene transfer techniques-vector meditated and vector less gene transfer.
Transgenic plants trans gene integration and expression

Module IV
Transgenic crop with new traits-herbicide tolerance, insect and disease resistance,
Therapeutic proteins and compounds
Oral vaccines
Production of secondary metabolites via tissue culture
Bioethics of plant genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Adacemic/Plenum Press
Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: BTB 502 **Credit Units: 03**

Course Objective:

The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I
Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering.

Module II
Cell culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures

Module III
In vitro fertilization and embryo transfer

Module IV
Somatic cell hybridization, hybridoma technology

Module V
Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer

Module VI
Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc.

Module VII
Bioethical issues related to animal biotechnology,

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References

Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
Cell Growth and Division – A Practical approach, R. Basega, IRL Press
Culture of Animal Cells, R.I Freshney, Wiley-Leiss
Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

STRUCTURAL BIOLOGY

Course Code: BTB 503 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

Course Contents:

Module I: Chemistry of amino acids and peptides

Side chain structure and function in protein folding and functionality: Secondary structure of proteins -helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Structure and function of an antibody; structure of hemoglobin, muscle proteins; Sequence and structural motifs in proteins.

Module II: Protein-ligand interactions

Lock and key versus handshake mechanism of substrate recognition; structural basis of recognition; reaction mechanisms of enzymes, G-Protein coupled receptors.

Module III: Protein solubility, protein stability and stabilization

Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding

Module IV: DNA structure

Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules -Rasmol, Deepview, Whatif.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Biochemistry, R.H. Abeles, P.A. Frey and W.A. Jencks, Jones and Bartlett.
Essentials of Molecular Biology, D. Freifelder, Jones and Bartlett Publications.
Genes VII, B. Lewin, Oxford University Press.

References:

Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company.
Protein Structure, M. Perutz, Oxford University Press.
Proteins (Structures and Molecular Properties), T.E. Creighton, W.H. Freeman and Company.
Database Annotation in Molecular Biology, Arthur M. Lesk.
From Genes to Clones, E.L. Winnacker.
Genes & Genomes, M.S. Paul Berg.
Structure and Machanism in Protein Science, Alan Fersht.

CHEMICAL ENGINEERING PRINCIPLES

Course Code: BTB 504 **Credit Units: 03**

Course Objective:

The knowledge gained through chemical reaction engineering and material and energy balances will help the students to understand the tools and techniques of biotechnology.

Course Contents:

Module I: Material and Energy Balances
Units and dimensions, Dimensional analysis; Simple problems on material balance calculations involving unit processes and reactive systems; Available electron balances.
Basic energy concepts -enthalpy changes in chemical/biochemical reactions and in non-reactive processes, Energy balance calculations, Use of Steam tables; Heat of reaction and energy balance for microbial processes.

Module II: Chemical reaction engineering
Kinetics of homogenous reactions: Concepts of reaction rate, order of reaction and molecularity, Analysis of batch reactors for kinetic interpretation of data and isothermal reactor design for single and multiple reactions, Design equations for CSTR and plug flow reactors.

Module III: Instrumentation and process control
Principles of measurement: error, accuracy and sensitivity; Measurement of flow, pressure, temperature, level, pH, viscosity and chemical composition.
Basic concepts of feedback control, control loop and its elements, Dynamic behaviour of first, second and higher order physical systems, controller hardware, choice of controllers and settings. Introduction to advanced control systems: feed forward, cascade and ratio control.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, Prentice Hall
Basic Principles of Chemical Engineering, E.I. Shaheen, Houghton Mifflin

References:
Chemical Process Control, An introduction to Theory and Practice, G. Stephanopoulos, Prentice Hall Inc.
Chemical Reaction Engineering, O. Levenspiel, John Wiley and Sons Inc.
Elementary Principles of Chemical Processes, R.M. Felder and R.W. Rousseau, John Wiley and Sons Inc.
Fundamentals of Chemical Reaction Engineering, C.D. Holland and R.G. Anthony, Prentice Hall Inc.
Process Modelling, Simulation and Control for Chemical Engineers, W.L. Luyben, McGraw Hill

BASIC BIOANALYTICAL TECHNIQUES

Course Code: BTB 505 **Credit Units: 03**

Course Objective:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

Course Contents:

Module I: Solution and Buffers
Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.

Module II: Centrifugation
Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation.

Module III: Microscopy
Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy.
Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

Module IV: Radioisotope techniques
Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio – immunoassay.

Module V
Cell Disruption techniques, ultra filtration, dialysis and reverse osmosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
Crystallography made Crystal Clear, G. Rhodes, Academic Press
Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

JAVA PROGRAMMING

Course Code: CSE 403 **CreditUnits: 3**

Course Objective:

The objective is to impart programming skills used in this object oriented language java.The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I(7 Hours)

Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison.Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays

Module II(7 Hours)

Classes and Objects in Java: Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces.Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages.

Module III(6 Hours)

Multithreaded Programming:Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication.Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.

Module IV(7 Hours)

GUI Programming -Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers, Swing Packages, Exploring Swing components ,Generating Swing Application

Module V(3 Hours)

Event Handling -The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events.

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH

Introduction to JAVA Programming a primar, Balaguruswamy.

References:

“Introduction to JAVA Programming” Daniel/Young PHI

Jeff Frentzen and Sobotka, “Java Script” , Tata McGraw Hill,1999

Course Outcomes:

The student will learn

- Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- Students can demonstrate ability to implement multithreading in the programming.
- To learn syntax and features of exception handling
- Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings.
- To demonstrate the ability to handle Events in the Programming

PLANT BIOTECHNOLOGY LAB

Course Code: BTB 520 **Credit Units: 01**

Course Contents:

Module I
Sterilization of glasswares and equipments.
Preparation of cotton plugs and culture media
Preparation of stocks for culture media
Preparation of culture media

Module II
Preparation and sterilization of different explants
Inoculation of explants on culture media

Module III
Study of viability of seeds
Embryo culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL BIOTECHNOLOGY LAB

Course Code: BTB 521 **CreditUnits: 01**

Course Contents:

1. Preparation, standardization and sterilization of culture media
2. Inoculation of specific tissues for callusing
3. Inoculation and maintenance of cell lines
4. Study of toxicity on cell lines

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

STRUCTURAL BIOLOGY LAB

Course Code: BTB 522 **Credit Units: 01**

Course Contents:

Study of physical properties of proteins.

Analysis of protein structure.

Study of protein finger printing

Study of protein fractionation

Study of protein folding

Study of protein degadation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

JAVA PROGRAMMING LAB

Course Code: CSE 423 **Credit Units: 2**
Total Hours: 40

Course Objective:

Programming in the Java programming language, knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

Lab assignment will be based on the following: (40 Hours)

Use Eclipse or NetBeans platform and acquaint with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop. :**(2 Hours)**

Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero. :**(2 Hours)**

Develop an applet in Java that displays a simple message. :**(1 Hours)**

Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked. :**(1 Hours)**

Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 andNum2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box. :**(2 Hours)**

Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. :**(2 Hours)**

Write a Java program that connects to a database using JDBC and does add, delete, modify and retrieve operations. :**(1 Hours)**

Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially there is no message shown. :**(1 Hours)**

Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape. : **(1 Hours)**

Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout. :**(2 Hours)**

Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes). :**(1 Hours)**

Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab. It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables). :**(1 Hours)**

Implement the above program with database instead of a text file. :**(1 Hours)**

Write a Java program that takes tab separated data (one record per line) from a text file and inserts them into a database. :**(1 Hours)**

Write a java program that prints the meta-data of a given table. :**(1 Hours)**

2 Students are required to develop anJAVA based application or model as project.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

- Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

Text:

- Java Fundamentals - A comprehensive Introduction, HerbetSchidt and Dale Srien, TMH.

References:

- Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI.
- Object Orientd Programming through Java, P. Radha Krishna, Universities Press.
- Thinking in Java, Bruce Eckel, Pearson Education
- Programming in Java, Bruce Eckel, Pearson Education
- Programming in Java, S. Malhotra and S. Choudhary, Oxford Univ. Press.

Course Outcome:

- knowledge of the structure and model of the Java programming language, (knowledge)
- use the Java programming language for various programming technologies (understanding)
- develop software in the Java programming language, (application)
- evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
- propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

To enable the students to adopt strategies for effective reading and writing skills.

The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	Define Vocabulary Significance of Vocabulary One Word Substitution, Synonyms & Antonyms and Idioms & Phrases Define and Differentiate Homonyms, Homophones and Homographs Vocabulary Drills Foreign Words	
2.	**Module II Comprehension Skills**	**25% Weightage**
	Reading Comprehension-SQ3R Reading Techniques Summarising and Paraphrasing Précis Writing Listening Comprehension	
3.	**Module III Presentation Skills** Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** How Far is the River-Ruskin Bond My Wood-E.M.Forster I have a Dream-Martin Luther King Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** Communicate fluently and sustain comprehension of an extended discourse. Demonstrate ability to interpret texts and observe the rules of good writing. Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop Group Discussions Presentations Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.

Effective English for Engineering Students, B Cauveri, Macmillan India

***Creative English for Communication*, Krishnaswamy N, Macmillan**

Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan

AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 Course Credit: 01

Course Objective:

To inculcate in the students an elementary level of understanding of group/team functions .
To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation **(2 Hours)**

Definition and
Characteristics
Importance of group
Classification of groups
Stages of group formation
Benefits of group formation

Module II: Group Functions **(2 Hours)**

External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
Group Cohesiveness and Group
Conflict ▪ Adjustment in Groups

Module III: Teams **(2 Hours)**

Meaning and nature of teams
External and internal factors effecting team
Building Effective Teams
Consensus Building
Collaboration

Module IV: Leadership **(2 Hours)**

Meaning, Nature and
Functions • Self leadership
Leadership styles in
organization •Leadership in
Teams

Module V: Power to empower: Individual and Teams **(2 Hours)**

Meaning and Nature
Types of power
Relevance in organization and Society

Student learning outcomes

Students will develop critical and reflective thinking abilities
Students will demonstrate an understanding of group dynamics and effective teamwork
Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
Student will develop strategies to recruit, retain, and continually motivate contributing members to the organization.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

Organizational Behaviour, Davis, K.
Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers •Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour •Dressers, David and Cans, Donald: The Study of Human Interaction
Lapiere, Richard. T – Social Change
Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers.

Français-V

CourseCode: FLU544 **Credit units: 02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten
Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready
Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations, etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5 and6(révision) Dossier8:Vivre ensemble
ActesdeCommunication:
Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,
l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.
Dossiers4, 5,6–Révision
Exercicesd'écoute,productionorale et écrite.
Grammaire :
le présent (révision),lepassé composé(révision)
lespronomscomplémentsdirects,lespronomscompléments indirects
lesmarqueurschronologiques
lesarticulateurslogiques
ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:
Le livre àsuivre:
Andant, Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.
Andant, Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.
Référence:
Girardeau, Brunoet NellyMous.Réussirle DELFA1.Paris: Didier, 2010.

SUMMER PROJECT - I

Course Code: BTB 560 **Credit Units: 05**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

Title of the Report

The title of the report should remain same as that given in the synopsis.

Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

Abstract and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

List of Acronyms and Standards

The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

Production of Project Report

Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

SI
Make sure proper units, SI as far as possible, appear wherever required.

Title or Cover Page
The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Acknowledgements (optional)
Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Abstract
A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

Table of Contents
Titles and subtitles are to correspond exactly with those in the text.

Introduction
Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Review of Literature and Definition of Problem

Materials and Methods
This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Summary

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

(a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

RECOMBINANT DNA TECHNOLOGY

Course Code: BTB 601 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I: Enzymes used in RDT
Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.

Module II: Cloning vectors
Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering

Module III: Blotting techniques and hybridization
Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.

Module IV: Nucleic acid amplification and its applications
Principles of PCR, designing of primers

Module V: Cloning Techniques
Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure , Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immunoscreening.

Module VI: DNA Libraries
Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries.

Module VII: Sequencing of DNA
DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:
Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: **BTB 602** **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Michaelis Menten equation, Linear plots, King-Altman's method; Inhibitors and activators; Multisubstrate systems; ping-pong mechanism, Alberty equation, Sigmoidal kinetics and Allosteric enzymes

Module III
Immobilization of Enzymes; Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects.

Module IV: Enzyme reactors
Reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems, Mass transfer in enzyme reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reaction.

Module V: Bioprocess Design
Physical parameters, reactor operational stability, Immobilized cells.

Module VI: Challenges and future trends
Enzyme catalysis in organic media; catalytic antibodies and non protein biomolecules as catalysts, biocatalysts from extreme thermophilic and hyper thermophilic Archae and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.

References:

Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner.
Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience.
Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: BTB 603 **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I: Introduction

Phylogeny of Immune System, Innate and acquired immunity, clonal nature of Immune Response.
Organization and structure of lymphoid organs Nature and Biology of antigens and super antigens Antibody structure and function; Types of immunity- innate, acquired, active and passive.

Module II: Major Histocompatibilty

MHC, BCR and TCR, generation of antibody diversity, Complement system

Module III: Cells of the immune system

Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T -Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells

Module IV: Regulation of immune response

Antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance

Module V: Cell mediated toxicity

Mechanism of T cell and NK cell mediated lysis and macrophage mediated cytotoxicity.

Module VI: Hypersensitivity

Module VII: Autoimmunity

Module VIII: Tumor immunology, Immunity to infectious agents

Module IX: Transplantation Immunology

Module X: Synthetic vaccines

Vaccines: General consideration, ideotype network hypothesis, Synthetic vaccines

Module XI: Hnmunological Techniques

Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter

Module XII: Hybridoma technology and its applications

Fusion of myeloma cells with lymphocytes

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
Immunology, Roitt, Mosby – Yearbook Inc.
Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

COMPUTATIONAL BIOLOGY

Course Code: BTB 604 **Credit Units: 03**

Course Objective:

The objective is to describe relational data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures genetic mapping etc.

Course Contents:

Module I: Introduction and overview

The NCBI data model; sequence databases, sequence retrieval, sequence file formats, submitting DNA and protein sequences.

Types of biological databases, Databases and rapid sequence analysis

Module II: Sequence alignment

Global and local alignments, statistical significance of alignments, scoring matrices and gap penalties, filtering, position specific scoring matrices, internet resources, Pairwise and multiple alignment, uses of pairwise and multiple sequence alignment, programs and methods for sequence alignment, pattern searching programs, family and superfamily representation, structural inference, dynamic programming algorithms, alignment by hidden Markov models, consensus word analysis, more complex scoring.

Module III: Phylogenetic prediction

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module IV: Predictive methods using DNA and protein sequences

ESTs – databases, clustering, gene discovery and identification, and functional classification.

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification;

Module V

Molecular modeling – PDB and MMDB, structure file formats, visualizing structural information, advance structure modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Molecular mechanics and dynamics, Docking of Molecules, Knowledge base structure prediction, Molecular Design, structure similarity searching; Secondary structure prediction in proteins, prediction of buried residues in proteins;

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons

Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

References:

Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press

Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F Quellette, Wiley – interscience.

Bioinforamtics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. Von Heijne and G. Von Heijne, Academic Press.

FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Course Code: BTB 605 **Credit Units: 03**

Course Objective:

The course material on the kinetics of microbial growth, substrate utilization and product formation etc. may help the students to understand the various principles involved in instrumentation and control of bioprocess.

Course Contents:

Module I
Kinetics of microbial growth, substrate utilization and product formation.

Module II
Sterilization of air and medium.

Module III
Batch, continuous ,cell recycle and fed batch reactors; mass and energy balance in microbial processes, Bioreactor design, Different types of bioreactors, their parts and functions. Different types of valves.

Module IV
Mass transfer in Biological reactions; Scale-up principles; Instrumentation and control of bioprocesses.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
Biochemical Engineering Fundamentals, J E Baily and D F Oillis, McGraw Hill
Bioprocess Engineering Principles, P Doran, Academic Press

References:

Chemical Engineering, J M Coulson, and J F Richardson, Butterwirth Heinemann
Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, HC Vogel, CL Todaro, CC Todaro, Noyes Data Corporation/Noyes Publications
Process Engineering in Biotechnology, A T Jackson, Prentice Hall

RECOMBINANT DNA TECHNOLOGY LAB

Course Code: BTB 620 **Credit Units: 01**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

Module I
Study of cloning (GFP CLONING)
Module II
Study of PCR
Module III
Study of Southern hybridiosation
Module IV
Study of RAPD
Module V
Site directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code:BTB 621 **Credit Units: 01**

Course Objective:

The laboratory will help the students to isolate enzymes from different sources, enzyme assays and studying their kinetic parameters which have immense importance in industrial processes.

Course Contents:

Module I
Isolation of enzymes from plant and microbial sources.
Module II
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulase, protease.
Module III
Purification of Enzyme by ammonium sulphate fractionation.
Module IV
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity, determination of Michaelis-Menten constant (K_m) and Maximum Velocity ($V_{max.}$) using Lineweaver-Burk plot.
Module V
Effect of Temperature and pH on enzyme activity.
Module VI
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

Practical Biochemistry, Sawhney and Singh

References:

Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: BTB 622 **Credit Units: 01**

Course Contents:

Module I
Blood film preparation and identification of cells.
Module II
Identification of blood group.
Module III
Isolation of serum.
Module IV
Lymphoid organs and their microscopic organization.
Module V
WIDAL Test
Module VI
Radial Immuno Diffusion Test
Module VII
Ouchterlony Double diffusion Test
Module VIII: Elisa
DOT, SANDWICH
Module IX
Purification of lgG through affinity chromatography
Module X
Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

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COMPUTATIONAL BIOLOGY LAB

Course Code: BTB 623 **Credit Units: 01**

Course Contents:

List of Experiments/Exercises

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
Local and Global Alignment- concepts Pair wise sequence alignment
Multiple sequence alignment
Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
Motif and pattern searching
Phylogentic prediction and analysis
Structure predicition
Finding transcription regulatory signals
Docking

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILLS-VI

Course Code: BCU 641 — Credit Units: 1

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.
Prerequisites: NIL

Course Contents / Syllabus:

1. Module I Social Communication Essentials — **30% Weightage**

- Small talk
- Building rapport
- Expand social and Corporate Associations
- Informal Communication: Grapevine, Chat

2. Module II Workplace Interpersonal Skills — **25% Weightage**

- Understanding Social Communication in Workplace environment.
- Employee feedback: Assess employee performance and satisfaction.
- Simulation
- **Humour in Communication-Use of 'Puns'**
- **Entertainment and Communication (Infotainment)**
- Infotainment and Social Media
- Entertainment in Journalism
- **Social Networking**

3. Module III Visual Code / Social Etiquette — **35% Weightage**

- Power Dressing
- Fine Dining
- Office Party Etiquette
- Business Travel Etiquette
- **Work Place and Business Etiquette**
- Proper Greetings
- Thank You Notes
- Telephonic Manners/ Voice Mail Etiquette
- Business Salutation Etiquette
- Guest Etiquette
- Cubicle Etiquette
- Business Card Etiquette
- **Different Cultural Etiquette & Protocol**

4. Module IV Prose — **10% Weightage**

- Secret of Socrates - Dale Carnegie
- My Financial Career-Stephen Leacock
- The Luncheon - W. Somerset Maugham
- The National Flag - Jawahar Lal Nehru All

the four stories will be discussed in one class
One Long Question will be set in the Exam from the Text

5. Student Learning Outcomes:

- To communicate contextually in specific personal and professional situations with courtesy.
- To inject humour in their regular interactions.
- To strengthen their creative learning process through individual expression and collaborative peer activities.

6. Pedagogy for Course Delivery:

- Workshop
- Group Discussions
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text:
Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011
Communication and Organizational Culture. Keyton. Joann. Sage Publications
Social Communication (Frontiers of Social Psychology).Fiedler, Klaus. Psychology Press
Reference:
Cypherpunks: Freedom and the Future of the Internet. Assange, Julian Assange. OR Books.
Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Code: BSU-643 **Course Credit: 01**

Course Objective:

To develop an understanding the concept of stress its causes, symptoms and consequences.
To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

Meaning & Nature
Characteristics
Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

Stages of stress
The physiology of stress
Stimulus-oriented approach.
Response-oriented approach.
The transactional and interact ional model.
Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

Personal
Organizational
Environmental

Module IV: Consequences of stress **(2 Hours)**

Effect on behavior and personality
Effect of stress on performance
Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

Importance of stress management
Healthy and Unhealthy strategies
Peer group and social support
Happiness and well-being.

Student learning outcomes

Student will able demonstrate thorough understanding of stress and its effects
Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	**5**	**10**	**15**	**70**	**100**

Suggested Readings:

Blonna, Richard; Coping with Stress in a Changing World: Second edition
Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
express their sentiments, emotions and opinions, reacting to information, situations;
narrate incidents, events;
perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

présenter, caractériser, définir
parler de livres, de lectures
préparer et organiser un voyage
exprimer des sentiments et des opinions
téléphoner
faire une réservation

Contenu grammatical:

proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser

Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

le livre à suivre : Campus: Tome 1

BIOPROCESS TECHNOLOGY

Course Code: BTB 701 **Credit Units: 03**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process

Module II

Process technology for the production of primary metabolites, eg. biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Biomass: Bakers and distillers yeast production using various raw materials, “bios” factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides

Module III

Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture

Penicillin: Classification, various penicillin as precursor and ‘R’ – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc.

Streptomycin: chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc.

Tetracycline: chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.

Module IV

Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc

Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press

Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall

Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D’Elia, John Wiley and Sons Inc.

Bioprocess Engineering Principles, P Doran, Academic Press

Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.

Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press

Process Engineering in Biotechnolgy, A T Jackson, Prentice Hall

DOWNSTREAM PROCESSING

Course Code: **BTB 702** **Credit Units: 03**

Course Objective:

The syllabus will help the students to characterize the Bioproducts due to downstreaming process of biotechnological importance.

Course Contents:

Module I
Characteristics of Bioproducts; Coagulation, Flocculation and conditioning of broth.

Module II
Mechanical separation; Cell disruption techniques

Module III
Protein precipitation and separation

Module IV
Aqueous- two- phase extraction, Adsorption-desorption processes

Module V
Chromatographic methods of separation based on size, charge, hydrophobic interactions and biological affinity

Module VI
Membrane based separation; Dialysis, Electrodialysis; Micro filtration, Ultra filtration; Electrophoresis

Module VII
Crystallization; Drying

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill.
Bioseparatioins, P.A. Belter, E.L. Cussler and W.S. Hu, John Wiley and Sons Inc. Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering / Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society.
Protein Purification, M.R. Ladisch, R.C. Willson, C.C. Painton and S.E. Builder, American Chemical Society.

STATISTICS FOR BIOLOGY

Course Code: BTB 703 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice.

Course Contents:

Module I

Statistics and Biostatistics: Preliminary concepts.
Measures of Central Tendency: Mean, Median, Mode
Measures of Dispersion: Range, Standard deviation, Variance

Module II

Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.

Module III: Continuous Distribution

Normal Distribution, Properties of Normal distribution

Module IV: Correlation

Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, Some examples.

Module V: Regression

Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples. Method of least square: Fitting of straight line

Module VI: Introduction to the following Statistical terms

Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications.
Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test.
Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means.
Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity.
Analysis of Variance: One way and Two way (only Examples)

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand & Co.

References:

Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons
Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand & Co.
Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
Statistical Methods, Potri, D. Kalyani Publishers.
Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

BIOSENSORS

Course Code: BTB 704 **Credit Units: 03**

Course Objective:

The course aims at developing an understanding of Biosensor technology needed critically for the development of small, sensitive, and selective biosensor devices and detection systems that can reliably operate in real time and in extreme and diverse physical environments. Biosensors are important tools in food safety diagnostics, medical monitors, and detection systems for biological warfare agents.

Course Contents:

Module I

Introduction to MEMS

Module II: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors

Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and trnsducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Affinity Biosensors: Techniques and Protocols, K.R. Rogers and A. Mulchandani, Humana Press.
Biosensors and their Applicatrions, V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
Chemical Sensors and Biosensors, B.R. Eggins, John Wiley and Sons Inc.
Sensors and Sensing in Biology and Engineering, F.G. Barth, wt al, Springer Verlag.

THERMODYNAMICS OF BIOLOGICAL SYSTEMS

Course Code: BTB 705 **Credit Units: 03**

Course Objective:

The main aim is to understand the basis of theories related to combustion and dissolution. It will help in the study of heat evolution, control of dissipation and will suggest ways for solving the rate phenomena through the dynamics of mass transfer applicable to biological process

Course Contents:

Module I
Energy, thermodynamics and living processes - an introduction

Module II
Energetic processes in the biosphere: The ecosystem.

Module III
Thermodynamics systems: equilibrium, activity coefficients and phase equilibrium functions of state, cyclic processes, work, energy and metabolic heat; Mechanical equivalent of heat, energy as a function of state.

Module IV: The laws of thermodynamics
Second law; Reversible vs. irreversible processes entropy, work; Combination of the first and second law, Free energy, useful work and delta G. Entropy: Ideality and Molecular Cohesion, Probabilistic nature of Entropy, Order and Disorder.

Module V: Biological systems as open, non-equilibrium systems
Failure of classical thermodynamics in describing biological processes, Standard free energy changes and equilibrium constants, direction and rate.

Module VI: Chemical potential
Visualization of the potential velocity and steady flow; Fick's law and diffusion. Local Equilibria and steady state: Energy vs. Power; Transducers in biological states, Constitutive equations, Dynamic efficiency and Onsager (nonequilibrium thermodynamics), Prigogine's principle, Spontaneous coupling and entropy production.

Module VII: Non-equilibrium thermodynamics
Reversible work, exact differentials and function of state, first and second law, The electrochemical potential, External forces an steady state, Fick's Law, chemical reactions in the steady state, internal entropy production, cells as non-equilibrium stationary states; Diffusion and membrane transport. Thermodynamic analysis of oxidative photophospghorylation, stability of non-equilibrium stationary states, ordering in time and space far from equilibrium, glycolytic oscillations, biological clocks, routes to chaos.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Bioenergetics, A.L. Lehninger, W.A. Benjamin Inc.
Biological Thermodynamics, D.T. Haynie, Cambridge University Press.
Biophysical Chemistry, C.R. Cantor and P.R. Schimmel, Freeman
Physical Chemistry: Principles and Applications in Biological Sciences, I. Tincoco, K.Sauer and J.C. Wang, Prentice Hall College Division.
Physical Chemistry for the Chemical and Biological Sciences, R. Chang, University Science Books
Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, John Wiley and Sons Inc.

PHARMACEUTICAL CHEMISTRY AND DRUG DESIGN

Course Code: BTB 706 **Credit Units: 03**

Course Objective:

The main objective of this course is to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. The contents will introduce them to various drug molecules used in treatment, mitigation and cure of different disease. The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I

Introduction of pharmaceutical Chemistry, Overview of drug discovery process.

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action

Module II: Drug Targets and their validation

Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins

Validation Strategies

Module III: Drug Design Strategies

A. Structure-based design-Docking and denovo methods

B.Design and development of combinatorial libraries for new lead generation

The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemiometrics in drug design.

C. QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.

Module IV

Drug toxicity, tolerance, dependence, addiction, Dose Response curves

Module V

Survey of various Drug Classes – Anaesthetics (general, local), Analgescis, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids- Mechanism of action and applications

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins

References:

Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press

Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston

Side Effects and Drug Design, E.J. Lien, Marcel Dekker

The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press

Pharmaceutical Dosage forms and Drug Delivery Systems, H.C. Ansel , L.V. Allen, N.G. Popovich, Lippincott Williams and Wilkins Publishers

Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry, T.L. Lemke, Lea and Febiger

CURRENT TOPICS IN BIOTECHNOLOGY

Course Code: BTB 707 **Credit Units: 03**

Course Objective:

A complete understanding of the application of biotechnology in various fields can be understood by studying the various modules of this paper. Success of biotechnology depends largely on how it can be effectively utilized in finding solutions to many vexed problems of present day society. The objective of this paper is to familiarize the students with some of the frontier areas if biotechnological applications where a huge scope for further contributions for betterment of the society exists. The paper shall be a interface between the students and the social at large.

Course Contents:

Module I: Bioremediation

Introductory concept, Bioremediation principles, mechanism for Bioremediation of air, water and soil pollutants, bioremediation examples, commercial application of bioremediation techniques, recombinant DNA technology and bioremediation, bioremediation models, bioremediation software

Module II: Genetically modified organisms

Genetically modified food crops, food animals – examples and mode of production, future goals in GM food crops and animals, scientific evaluation of public concerns, legal requirements in production of GMO, current trends and consumer acceptance.

Module III: Molecular medicine

Gene mutation, point mutation, allele specific oligonucleotides, ARMS, oligonucleotide ligation, disease diagnosis with linked genetic markers, fluorescently labeled DNA sequencing.

Module IV: Nano-biotechnology

Introduction, definition, hybrid nanopracticles, smrat drug delivery, gene sensors, biomolecule control, nanofluids, nanotechnology in medicine.

Module V: Stem cells

Definition, properties, proliferation, culture of stem cells, medical applications of stem cells, ethical and legal issues in use of stem cells.

Module VI: Cancer Biology

Types of cancer, development, causes and properties of cancer, viruses (Hepatitis B & C, SV4U, polymo marines, pupillomarines, adenosines, retrovineses); retroviral oncogenes, proto-oncogenes, turmor suppressor genes, recent advances in detection and treatment of cancer.

Module VII: Forensic Biotechnology

MLP, SLP technology, PCR technology in crime detection, STR and databases, mitochondrial DNA and Y chromosome analysis in forensic science, DNA chip technology, role of molecular biology and biotechnology in crime detection.

Module VIII: Bio sensor

Biological reaction, amperometric biosensor, potentiometric biosensor, conductimetric bioseosors, calorimetric biosensor, piezoelectric biosensor, whole-cell biosensor, immunosensors.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

The Cell – A molecular Approach, 3rd Edn, Geoffrey M. Cooper and Robert E. Hausman, ASM Press

Molecular Biology and Biotechnology, 4th Edn, J.M Walker and R. Rapley, Panima Books

Cell Biology, David. E. Sadava, Panima Books

Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press

Environmental Microbiology, 2nd Edition, Ian L. Pepper and Charles P. Gerba, Elsevier Pub.

Environmental Biotechnology – Concepts and Application, Hans – Joachim Jordening and Jesefwinter – Wiley – VCH

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BTB 708 **Credit Units: 03**

Course Objective:

Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents:

Module I: Introduction

Ecology and ecosystem.

Module II: Environmental pollution

Water, soil and air, noise and thermal pollution, their sources and effects.

Module III: Waste water (sewage and industrial effluents) treatments

Anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria- technical process and conditions, emerging biotechnological processes in waste - water treatment.

Module IV: Solid waste management

Landfills, composting, earthworm treatment, recycling and processing of organic residues**.**

Module V: Biodegradation

Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution

Module VI: Microbial leaching and mining

Microbial leaching and mining: Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Module VII: Wasteland

Wasteland: Uses and management, bioremediation and biorestoration of contaminated lands.

Module VIII: Environmental genetics

Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.

Module IX: Hazardous wastes

Hazardous wastes: source management and safety.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Environmental Biotechnology by PK Mohapatra

References:

Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
BiotreatmentSystems, Vol.22, D. L. Wise (Ed.), CRCPress, INC.
Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association.

BIOPROCESS PLANT DESIGN

Course Code: BTB 709 **Credit Units: 03**

Course Objective:

The objective of this paper is to include not only the application of chemical engineering principles/unit operations to bioprocess systems but also to include the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I

Introduction; general design information; Mass and energy balance; Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Applied Process Design for Chemical and Petrochemical Plants, E.E. Ludwig, Butterworth-Heinemann
Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann
Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw-Hill
Manufacturing Facilities Design and Material Handling, F.E. Meyers and M.P. Stephens, Prentice Hall
Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus, McGraw-Hill
Process Plant Layout and Piping Design, E. Bausbacher and R. Hunt, Prentice Hall PTR.

ARTIFICIAL NEURAL NETWORKS

Course Code: BTB 710 **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, beides the closely related aspects of artificial neural networks.

Course Contents:

Module I
Historical background, Why is learning hard?

Module II
Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multi-layer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning,

Module III
The backpropagation algorithm, Aspects of Learning Theory and Generlization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?

Module IV
Neural networks and analog VLSI, Selected Applications

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Neural Networks: A Comprehensive Foundation, S. Haykin, Prentice Hall
Neutral Networks for Pattern Recognition, C. Bishop, Oxford University Press

ADVANCED JAVA PROGRAMMING

Course Code: CSE 504 **CreditUnits: 03**
Total Hours: 30

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Course Contents:

Module I (5 Hours)

Introduction to Java RMI, RMI services, RMI client, Running client and server, Introduction of swing, swing components, Introduction to Multimedia Programming

Module II (5 Hours)

Database Connectivity using JDBC- Understanding JDBC, Define the layers in JDBC architecture, various types of JDBC drivers, manipulating various SQL Queries, Manage transactions and perform batch updates in JDBC, Creating Database Connectivity Applications, Connection to Database with the java.sql Package.

Module III (8 Hours)

Introduction to sever side programming, Introduction to Servlets, Web Container, Servlet Life Cycle, and Servlet based Applications, Servlet and HTML. Web.xml file. Session tracking

Module IV (6 Hours)

JSP: Introduction to JSP, JSP architecture, JSP syntax Basics, JSP implicit objects, JSP based Applications. The Model-View-Controller Architecture. Session management.

Module V (6 Hours)

Enterprise Java Beans:-EJB roles—EJB Client-Object -container-Transaction Management—implementing a Basic EJB Object-Implementing session Beans-Implementing Entity Beans-Deploying an enterprise Java Beans Object-Changes in EJB1.1 specification.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
Professional Java Server Programming (a Press) By Allamaraju
Developing Java Servlets (Techmedia – SAMS) By James Goodwill
Using Java 1.2 Special Edition (PHI) By Webber

References:

David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
Dietal and Deital, "JAVA 2" PEARSON publication

Course Outcomes:

The student will learn

- Can develop Java Applets, Beans programming.
- Can Understand Advanced Java Networking concepts and develop server side application.
- Can learn Server Side Programming Concepts and create Dynamic web Application.
- Know about the JDBC Principles and can interact with back end database with java programming.
- Understand the application server and also understand the enterprise level applications.

BIOPROCESS TECHNOLOGY LAB

Course Code: BTB 720 **Credit Units: 01**

Course Contents:

Module I
Isolation of industrially important micro organisms for microbial processes.
Module II
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Module III
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.
Module IV
Comparative studies of ethanol production using different substrates.
Module V
Production of single cell protein
Module VI
Production and estimation of alkaline protease
Module VII
Sauer Krant fermentation
Module VIII
Use of alginate for cell immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

DOWNSTREAM PROCESSING LAB

Course Code: BTB 721 **Credit Units: 01**

Course Objective:

The laboratory will help the students to extract different bioproducts during their characterization since any of these products may be of biotechnological importance. They can be exploited in exploring the future biotechnology.

Course Contents:

Module I
Conventional filtration and membrane based filtration
Module II
Protein precipitation and recovery
Module III
Aqueous two-phase separation
Module IV
Ion exchange chromatography
Module V
Gel Permeation chromatography
Module VI
Electrophoresis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

Text:
Practical Biochemistry, Sawhney and Singh
References:
Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher
Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

ADVANCED JAVA PROGRAMMING LAB

Course Code: CSE 524 **CreditUnits: 1**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Programming Language: Java

Implement two services that should be run on a given network host. You should use JavaRMI. Develop a basic arithmetic calculator with the help of java RMI.

Write a Java program that can create an employee form for inserting the detail of employee in an organization by using Applets create a JFrame which have labels, text box, Radio button, Check Box, button etc.

For the above form write a programme to handle the events for checking the data input by user.

WAP that implement a JApplet and display the following frame

Customer name
Customer number
Age
Address

Write a Java program to access a table Employees for Oracle Sample database in HR Schema using Java code.

Write a Java program to manipulate a table Employees for Oracle Sample database in HR Schema using Java code.

Write a Java program that implement a simple servlet program.

Write a Java program for authentication,

Create the Web Page for User-Name and Password
Validate the login-id and password by the servlet code.
Connecting a database using user-id and password.

Write a Java program to product selling web site

Read data send by the client (HTML page)
Insert data into the database using the prepared statement.
c). Display the output to client for item purchased or not.

Write a Java program to include a HTML page into a JSP page to product purchasing.

Read data send by the client (HTML page)
Insert data into the database using the prepared statement.
c). Display the output to client for item purchased or not.

Write a Java program using Enterprise Java Beans for creating an application

Adding a Session EJB component to handle the business logic of the J2EE Application.
Integrating the DAO into the Session EJB.
Adding an Entity EJB
Integrating the Entity EJB into the Session EJB.
Interfacing the Web Tier with the Session EJB.

Examination Scheme:

IA				**EE**	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

<u>Text & References:</u>

Text:

Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski

Professional Java Server Programming (a Press) By Allamaraju

Developing Java Servlets (Techmedia – SAMS) By James Goodwill

Using Java 1.2 Special Edition (PHI) By Webber

References:

David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
Dietal and Deital, “JAVA 2” PEARSON publication

Course Outcomes:

Ability to design and develop Java Applets, Beans programming.
Ability to design and structure the Server Side Programming Concepts.
Ability to Create and design Dynamic web Application.
Write the structured code for JDBC (back end database).
Ability to develop and design the enterprise level applications.

COMMUNICATION SKILLS-VII

Course Code: BCU 741 **Credit Units: 1**

Course Objective:

The course is designed to empower students to carry out day to day communication at the work place by adequate understanding of various types of communication to facilitate efficient interpersonal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Meetings**	**30% Weightage**
	Notices Circulars Agenda Minutes	
2.	**odule II Report Writing & Telephony Skills**	**25% Weightage**
	Report Writing Purpose/Significance Types Format **Telephony Skills** Call Receiving/ Handling/ Concluding Etiquette Voice Modulation Effective Listening Dos and Don'ts of Telephony Skills	
3.	**Negotiation Skills** Definition/Concept Purpose/ Significance Checklist- Good & Bad Practices	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	The Great Trial-Robert Payne The Home Coming - Rabindra Nath Tagore How Much Land does a Man Need? - Leo Tolstoy Valiant Vicky, The Brave Weaver - Flora Anne Steel All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
Student Learning Outcomes: Conduct all business activities related to the workplace with technical efficiency. Contribute positively to the overall growth of the organization.		
6.	**Pedagogy for Course Delivery:** Workshop Group Discussions Presentations Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
T.N Chabbra , Business Communication , Sun India Publication.

Sanjay Kumar & Pushplata , Communication skills , Oxford University Press.

Reference: *Jones, Working in English, First Edition, Cambridge, CUP, 2001*.
AdditionalReading:NewspapersandJour

Behavioural Science - VII

Course Code: BSU-743 **Course Credit: 01**

Course Objective

This course will help the students to:
Explore interest and attitude
Explore career opportunities
Set career goals
Developing attributes that employers value

Course Contents:

Module I: Career Planning **(2 Hours)**

Importance of Career Planning & Development
Career Development Plan
Assessment of Career Development

Module II: Career Success: Interest, Aptitude & Attitude (Personality) **(2 Hours)**

Interest, Aptitude & Attitude
Knowing and assessing one's Interest
Knowing and assessing one's Aptitude

Module III: Explore Career for Growth **(2 Hours)**

Selecting from available resources
Career selection (Jobs)
Career planning and development

Module IV: Self Reliance and Employability skills **(2 Hours)**

Self awareness, Self promotion and Presentation, Self confidence
Action planning, Networking, Negotiation
Political awareness, Coping with uncertainty,
Developing positive attributes at work place (personal and professional)
Time Management as Self Management

Module V: Impression Management for Career Enhancement **(2 Hours)**

Meaning & Components of Impression Management
Impression Management Techniques(Influencing Tactics)
Impact of Impression Management on Career Planning and Development

Student learning outcomes:

Students develop the ability to identify suitable career options and to create a suitable career plan based on the utilization of the counseling process, assessment tools, and other resources.
Students will know how to assess their skills, interests and values.
Students will know how to make informed career choices based on their self- assessment.
Students will know how to explore relevant career options and build skills pertinent to those of greatest interest.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

Organizational Behaviour, Davis, K.
Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
Dressers, David and Cans, Donald: The Study of Human Interaction
Lapiere, Richard. T – Social Change
Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-VII

CourseCode:FLU744 **Creditunits:02**

CourseObjective:

Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable
- Todescribe anobject, compare objectsandevaluate
- Toaskforinformation, precision
- Tomake claims

CourseContents:

Dossier2–pg17-28,Dossier2:64millionsde consommateursActesdeCommunication:

Décrireunobjet(unbijouunique,unvoyageextraordinaire,unnouvelappareil photo)
Évaluerune chose (acheteruncadeau,discuterleprix)Ouvriruncompteà la banque (demanderdesrenseignementsaubanquierafind'ouvriruncompte) Demanderdes informations/précisions(précisionssurunproblème danslerelevéde compte)
Faire uneréclamation(s'adresserauservice après-vente pouréchangerunproduit défectueux)

Thèmesabordés:

S'habillerbonmarché (commentvoushabillez-vousbonmarché ?)
Le e-commerce (le portrait del'e-acheteurde votre pays)
Lesproduitscontrefaits(parlerdesproduitscontrefaits)
Laprofession:Lesmaraîchers(débats:commentéviterlegaspillage?lamodedeviedesdécroissants,privilégie-t- onla qualité oule prixlorsd'unachat?)

Grammaire :

Le pronom " en "
Laplace de l'adjectif
Le présent progressif
Le passé récent
Le futurproche(révision)
Le comparatifet le superlatif

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010

SUMMER PROJECT - II

Course Code: BTB 760 **Credit Units: 06**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.

The students will be supervised by the internal faculty during the tenure of training.

The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

Title of the Report

The title of the report should remain same as that given in the synopsis.

Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

Abstract and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

List of Acronyms and Standards

The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

Production of Project Report

Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

SI

Make sure proper units, SI as far as possible, appear wherever required.

Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Review of Literature and Definition of Problem

Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Summary

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

(a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

GENOMIC AND PROTEOMICS

Course Code: BTB 801 **Credit Units: 03**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics.

Course Contents:

GENOMICS

Module I: Genome Evolution

Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).

Module II: Structural Genomics

Chromosome structure and Genome organization, Genome sequencing methods, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.

Module III: Comparative Genomics

Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.

Module IV: Functional Genomics

ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools

Module V: Genotyping Background and Applications.

Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.

PROTEOMICS

Module VI: Fundamentals of Proteomics

Proteomics Basics and 2D Gel Electrophoresis,
Protein Identification and Analysis:
Protein preparation and Separation
Protein Identification by mass spectrometry
Identification of post translation modification
Protein Expression Mapping,
High-throughput cloning of ORFs,
Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease.
Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
Genomes II, T.A. Brown
Biotechnology and Genomics by P.K.Gupta

References:

A Primer of Genome Science, Greg Gibson and Spencer V. Muse
Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
DNA : Structure and Function, Richard R. Sinden
Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
Genes & Genomes, Maxine Singer and Paul Berg
Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
Proteomics, T. Palzkill, Kluwer Academic Publishers
Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.
Genome II by T.A.Brown

DRUG DELIVERY SYSTEMS

Course Code: BTB 802 **Credit Units: 03**

Course Objective:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)

Module III: Drug administration
Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery.
Current technologies and new and emerging technologies in oral delivery
Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

MANAGEMENT ACCOUNTING AND COST CONTROL

Course Code: BCH 621 **Credit Units: 01**

Course Objective:

The course aims to develop an understanding of the importance, language and techniques of Financial, Cost and Management accounting, skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making. Student should be able to understand the basic concepts of Company accounts with reference to the Indian context.

Course Contents:

Module I

Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements

Module II

Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application

Module III

Variable and Absorption costing, Job-Costing and Process-Costing Systems,

Module IV

Tools for planning and control, Master budget, Flexible Budgets and Variance analysis

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Cost Accounting, C.Horngreen, Prenctice Hall

Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

Management Accounting, C. Horngreen, Prenctice Hall

PROJECT MANAGEMENT

Course Code: BCH 622 **Credit Units: 01**

Course Objective:

The course aims atmaking an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process. Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Course Contents:

Module I: Introduction
Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure

Module II: Project Training
Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.

Module III: Project initiation
Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control

Module IV: Managing Risk
Risk Management Process: Risk Identification, Risk Assessment.
Risk Response Development: Risk Response Control

Module V: Project Termination
Project Auditing and Termination

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:
Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin

David H Holt, Entrepreneurship : New Venture Creation

References:

The Practice of Management, P. Drucker, Harper Business.

ASP .NET

Course Code: CSE 804 **Credit Units: 03**
Total Hours: 30

Course Objective:
To create web based applications using ASP.NET and c#. Learns to create window based applications

Course Contents:

Module I: Introduction to .NET technologies (6 Hours)
Features of .NET, .NET Framework, CLR, MSIL, .NET class library, .NET Languages, CTS, assemblies, manifest, and metadata, What is ASP.NET?, Difference between ASP and ASP.NET.

Module II: Controls in ASP.NET (6 Hours)
Overview of Dynamic Web page, Understanding ASP.NET Controls, Applications, Web servers, Installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, validation Controls: Required Field Comparison Range. Calendarcontrol, Ad rotator Control, Internet Explorer Control.

Module III: Overview of ADO.NET and XML(8 Hours)
What is ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets , using Command & Data Reader, binding data to data bind Controls, displaying data in data grid, XML basics, attributes, fundamental XML classes: Document, text writer, text reader. XML validations, XML in ADO.NET, The XML Data Document.

Module IV: ASP.NET Applications(6 Hours)
Creating, tracking, caching, error handling, Securing ASP.NET applications- form based applications, window based application.

Module V: Web services(4 Hours)
Introduction, State management- View state, Session state, Application state, Building ASP.NET web services, working with ASP.NET applications, creating custom controls.

Course Outcomes:
The student will learn
- Develop dynamic web applications, create and consume web services
- Use appropriate data sources and data bindings in ASP.NET web applications
- Research and discover information about current topics, illustrate in an example, and present to the class.

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
ASP.NET Unleashed by Stephen Walther, SAMS publications

References:
ASP.NET, Wrox Publications
ASP.NET and VB.NET, Wrox Publication
ASP.NET and C#.NET, Wrox publication.

GENOMICS AND PROTEOMICS LAB

Course Code: BTB 820 **Credit Units: 01**

Course Contents:

Module I
Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II
DNA sequencing methods

Module III
Gene finding tools and Genome annotation

Module IV
Comparison of two given genomes

Module V
Analysis of 2D – IEF data

Module VI
Microarray and Microarray data analysis

Module VII
Inference of protein function from structure

Module VIII
Inference of protein function and structure

Module IX
Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ASP.NET LAB

Course Code: CSE 824 **Credit Units: 01**
Total Hours: 20

Course Objective:
This course is designed to provide the knowledge of Dot Net Frameworks along with C#

Software Required: Visual Studio and SQL server

Topics covered in lab will include the following Programs:

Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.

Write a simple ASP.NET program to display the following Web Controls:

A button with text "clicks me". The button control must be in the center of the form.
A label with a text hello.
A checkbox.

The form name must be Web Controls

Write a program to display "Welcome To Radiant" in the form when the "click" button is clicked. The form title must be ASP.NET.

IV. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.

Write a program containing the following controls:

A ListBox
A Button
An Image
A Label

The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.

Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.

Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.

Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.

Check the length of the string in the TextBox using CustomValidator.

Course Outcomes:
After completion of the course the student will be able to use the features of Dot Net Framework along with the features of C#

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL – VIII

Course Code: BCU 841 **Credit Units: 1**

Course Objective:
This course is designed to hone the creative minds of students to develop knowledge of diverse ethnic groups and cultures and to increase self-awareness for cultural competence and sensitivity.
Prerequisites: NIL

	Course Contents / Syllabus:	
1.	**Module I Speaking in Public** Essentials in Public Speaking Parameters of Public Speaking	**45% Weightage**
2.	**Module II Cross Cultural Communication** Culture and Context Awareness & Significance of Understanding Culture Ethnocentrism, Stereotyping and Cultural Relativism Cultural Shock and Social Change	**45% Weightage**
3.	**Module III Prose**	**10% Weightage**
4.	India Cinema: Tradition & Change-Chidananda Das Gupta Kabuliwala-Rabindranath Tagore The Duchess and the Jewelller -Virginia Woolf The Park- James Mathews All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
	Student Learning Outcomes: Students will be able to navigate cross cultural encounters in a global economy. Facilitate students to develop learning to construct and deliver messages that incorporate the appropriate use of organizing content, language, vocabulary, kinesics, eye contact, appearance, visual aids, and time constraints.	
5.	**Pedagogy for Course Delivery:** Workshop Group Discussions Presentations Lectures	
6.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
Raman, Meenakshi. Business Communication, Oxford
Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011
References:
Beamer, Linda. Intercultural Communication in the Global Workplace, Irwin/McGraw-Hill, 2005.
Reynolds, Sana & Deborah Valentine. Guide to Cross-cultural Communication, Prentice Hall, 2003.
Additional Reading: Newspapers and Journals.

Behavioural Science – VIII

Course Code: BSU-843 **Course Credit:01**

Total Hours: 10

Course Objective:

To have a great deal of insight into one's character.
Understanding of positive emotions
To explore the dimensions of happiness, well-being, Optimism and hope
Quick understanding of different situations and grasp new concepts.

Course Contents:

Module I: Positivity in personality **(2 Hours)**

Importance of Positivity in personality
Positivity Vs. Negativity
Introspection and personal growth

Module II: Positive Emotions **(2 Hours)**

Understanding positive emotions
Importance of Positive emotion
Types and identification of positive emotions (Love, happiness, Contentment, Resilience, etc.)

Module III: Hope, Optimism and Resilience **(2 Hours)**

Positive approach towards future
Benefits of Positive approach
Resilience during challenge and loss

Module IV: Application of Positive Emotions **(2 Hours)**

Application of positive emotions in relationships, and organizations
Creating healthy organizational climate
Positive emotions enhances performance.

Module V: Happiness and Well Being **(2 Hours)**

Concept of Happiness & Well-Being
Secret of happy mind and healthy life
Work life balance.

Student learning outcomes:

Students develop the ability to identify and regulate positive emotions for personal and professional excellence.

Students will know how to develop resilience.
Students will know how to role of happiness to attain wellbeing.
Students will know how to nurture personality by positivity.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.

Kamalavijayan D. (2005). Information and Knowledge Management Macmillan India Ltd. Delhi.

Français-VIII

Course Code:FLU844 **Creditunits:02**

Course Objective:
Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable
- Toexpressanintention, announce a news, enquireaboutanevent
- To speakaboutthe future
- Todiscussthemedia

Course Contents:
Dossier3–pg29-40, Dossiers1&2(révision). Dossier3:Médias.frActesdeCommunication:
Parlerdel'avenir(lesavantageset lesinconvénientsdesréseauxsociaux)
Exprimeruneintention(poserdesquestion ssurunforum) Parlerdesmédias
Engager/ terminerune conversation(demanderpourquoionn'a pasréponduaumèl)
Interrogersurunévénement (vol,accident)
Annoncerunenouvelle (celle de démission)
Thèmesabordés:
LesFrançaiset la presse (débat: Croyez-vousauxlégendesurbaines?)
LesFrançaisetInternet(débat:lesinformationsdelapresseécritesontplusfiablesquelesinformationss urInternet ?)
LatélévisiondesFrançais
Laprofession: Lesanimateursradio(débat : pouroucontre le téléchargement illégal de la musique oudesfilms)
Grammaire :
Le futursimple
L'hypothèse surlefutur
Lesformesde la négation
Lespronomscomplémentsdirectset indirects (révision)
ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:
- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

MAJOR PROJECT

Course Code: BTB 860 Credit Units: 16

Course Objective:

The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

A short account of the activities that were undertaken as part of the project;
A statement about the extent to which the project has achieved its stated goals.
A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

Title of the Report

The title of the report should remain same as that given in the synopsis.

Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate’s name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

Certificate
This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

Acknowledgements
This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

Abstract and **Keywords**
This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

Contents
This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

List of Figures and List of Tables
Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

Nomenclature and Abbreviations
All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

List of Acronyms and Standards

The Chapters
Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

References/ Bibliography
Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

Appendices (if applicable).
Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

Production of Project Report
Report Size
The maximum number of pages of the Report should be preferably between 30-50 pages.

Paper Size
The standard size of paper of a Report is A4 paper must be used for printing the report.

Single-Sided Printing
It is suggested that the report be printed on one side of the paper.

Non-Paper Material
Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

Binding
First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

Format of Project Report
After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

Font
For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

SI
Make sure proper units, SI as far as possible, appear wherever required.

Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Review of Literature and Definition of Problem

Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Summary

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

(a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	100
Viva Voce:	100
Total:	**200**

AMITY UNIVERSITY
MADHYAPRADESH

Bachelor of Science (Honours) Biotechnology

Programme Code: BSB

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2017 - 2020

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2017

PROGRAMME OBJECTIVE

B. Sc. (H) Biotechnology aims to develop highly specialized hard core specialization in various diversified areas of biotechnology and its application to medicine, agriculture, environment, nutraceuticals and functional food etc.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research orientated project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practical conducted in well equipped laboratories in the area of Biotechnology, Animal Biotechnology & Immunology. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biotechnology.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses:						
BSB 101	Cell Biology	3	-	-	3	
BSB 102	Maths & Biostatistics	3	-	-	3	
BSB 103	Plant Sciences – I	3	-	-	3	
BSB 104	Animal Sciences-I	3			3	
BSB 105	Chemistry – I	3	-	-	3	
BSB 106	Environment Studies - I	2	-	-	2	
BSB 120	Biotechnology Lab - I	-	-	2	1	
BSB 121	Chemistry Lab – I	-	-	2	1	
BSB 122	Plant Sciences Lab - I	-	-	2	1	
BSB 123	Animal Sciences Lab-I			2	1	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BSB 141	English Language Usage Essentials	30	-	-		
BSB 143	Understanding Self For Effectiveness	30	-	-		
 BSB 144 BSB 145 BSB 146 BSB 147 BSB 148	Foreign Language – I French German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses:						
BSB 201	Introductory Biochemistry & Biophysics	3	-	-	3	
BSB 202	Bioanalytical Techniques	3	-	-	3	
BSB 203	Plant Sciences – II	3	-	-	3	
BSB 204	Animal Sciences-II	2	1		3	
BSB 205	Chemistry – II	3	-	-	3	
BSB 206	Environment Studies – II	2	-	-	2	
BSB 220	Biotechnology Lab – II	-	-	2	1	
BSB 221	Chemistry Lab – II	-	-	2	1	
BSB 222	Plant Sciences Lab – II	-	-	2	1	
BSB 223	Animal Sciences Lab-II	-	-	2	1	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BSB 241	Introduction to Communication Skill	30	-	-		
BSB 243	Individual, Society and Nation	30	-	-		
 BSB 244 BSB 245 BSB 246 BSB 247 BSB 248	Foreign Language – II French German Spanish Japanese Chinese	30	-	-		

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses:						
BSB 301	Genetics	3	-	-	3	
BSB 302	Microbiology	3	-	-	3	
BSB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BSB 304	Anatomy & Plant Physiology	3	-	-	3	
BSB 305	Animal Physiology-I	2	1	-	3	
BSB 306	Chemistry – III	3	-	-	3	
BSB 320	Biotechnology Lab – III	-	-	4	2	
BSB 321	Chemistry Lab – III	-	-	2	1	
BSB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BSB 323	Animal Physiology Lab-I	-		2	1	
BSB 330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**25**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BSB 341	Effective Written Communication	30	-	-		
BSB 343	Problem Solving & Creative Thinking	30	-	-		
 BSB 344 BSB 345 BSB 346 BSB 347 BSB 348	Foreign Language – III French German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
BSB 401	Bioinformatics	3	-	-	3	
BSB 402	Molecular Cell Biology	3	-	-	3	
BSB 403	Immunology	3	-	-	3	
BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BSB 405	Animal Physiology-II	3	-	-	3	
BSB 406	Chemistry – IV	3	-	-	3	
BSB 420	Biotechnology Lab - IV	-	-	4	2	
BSB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BSB 422	Animal Physiology Lab-II	-	-	2	1	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BSB441	Professional Communication for Recruitment & Employability	30	-	-		
BSB 443	Values & Ethics for Personal & Professional Development	30	-	-		
 BSB 444 BSB 445 BSB 446 BSB 447 BSB 448	Foreign Language – IV French German Spanish Japanese Chinese	30	-	-		

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses:						
BSB501	Plant Biotechnology	3	-	-	3	
BSB502	Animal Biotechnology	3	-	-	3	
BSB503	Immunotechnology	3	-	-	3	
BSB504	Genomics & Proteomics	3	-	-	3	
BSB505	Recombinant DNA Technology	3	-	-	3	
BSB506	Microbial Technology	3	-	-	3	
BSB520	Biotechnology Lab - V	-	-	4	2	
BSB521	Genomics & Proteomics Lab	-	-	4	2	
BSB 550	Summer Training (Evaluation)	-	-	-	5	
	TOTAL				27	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU541	Communication Skill - V	30	-	-		
BSU543	Behavioural Science - V	30	-	-		
 FLU544 GLU545 SLU546 JLU547 CLU548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses:						
BSB601	Environmental Biotechnology	4	-	-	4	
BSB602	Industrial Biology	4	-	-	4	
BSB623	Principles of Management & Entrepreneurship Development	1	-	-	1	
BSB620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BSB 660	Project (10-12 Week)	-	-	-	12	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU641	Communication Skill - VI	30	-	-	1	
BSU643	Behavioural Science - VI	30	-	-	1	
 FLU644 GLU645 SLU646 JLU647 CLU648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-	2	

CELL BIOLOGY

Course Code: BSB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
Cell and Molecular Biology - Sheelar & Bianchi, John Wiley

References:
Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
Cell Biology, Singh & Tomar
The world of the cell – Becker , Klinshmith & Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: **BSB 102** **Credit Units: 03**

Course Objective:
The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course
Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II
Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III
Measure of central tendency and measure of dispersion
Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution
Simple problems involving Binomial, Poisson and Normal variables,

Module IV
Correlation and regression,
Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:
Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: BSB 103 Credit Units: 03

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Algae
Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi
Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:, *Eurotium, Morchella, Agaricus* and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes
Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella, Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
College Botany Vol. I and II, Ganguli and Kar
A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain

References:
The Algae, V. J. Chapman and D. J. Chapman.
Introductory Phycology, H. D. Kumar.
A Text Book of Algae, H. D. Kumar and H.N. Singh.
Introductory Mycology, Alexopaulos and Mims
Cryptogamic Botany, G. M. Smith.
A Text book of Algae, B. R. Vashishtha
Bryophytes, N. S. Parihar
Pteridophytes, N. S. Parihar
An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: **BSB 104** **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species, Binomial nomenclature, classification-Hierarchy.
-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:
-Protozoa: Type study of *Plasmodium.*
-Porifera: Type of *Sycon.*

Module III
-Coelnterata: Type study of *Ovelia.*
-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates
-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*
-Arthropoda: Type Study of *Prawn*

Module V:
Mollusca: Type Study of *Pila*
Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: **BSB 105** **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules, Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.

References:
Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd**.**
Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
Atkin's Physical Chemistry, Atkin, Oxford Press.
Physical Chemistry, Vemulapalli, Printice Hall of India

ENVIRONMENT STUDIES

Course Code: BSB 106 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies
Definition, scope and importance
Need for public awareness

Module II: Natural Resources
Renewable and non-renewable resources:
Natural resources and associated problems
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems
Concept of an ecosystem
Structure and function of an ecosystem
Producers, consumers and decomposers
Energy flow in the ecosystem
Ecological succession
Food chains, food webs and ecological pyramids
Introduction, types, characteristic features, structure and function of the following ecosystem:
Forest ecosystem
Grassland ecosystem
Desert ecosystem
Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation
Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels
India as a mega-diversity nation
Hot-spots of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
Endangered and endemic species of India
Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**EE**
Weightage (%)	15	5	5	5	70

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: BSB 120 **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: BSB 121 **Credit Units: 01**

Course Contents:
INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate & potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxal atrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Plant Sciences - I

Course Code: BSB 122 Credit Units: 01

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia, Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Sciences - I

Course Code: BSB 123 Credit Units: 01

Study of museum specimens and slides, related to various phyla of invertebrates

Preparation of slides of amoeba, paramecium.

Dissection of earthworm and digestive system of earth worm

Dissection of cockroach and glycerin preparation of mouth parts.

Dissection of Pila.

Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: **BSB 141** **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	**A**	**CT**	**HA**	**EE**
Weightage (%)	05	15	10	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: **BSB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effect on personality
Building emotional competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning & Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and Nature of Attitude
Components and Types of Attitudes
Relevance and Importance of Attitudes

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, Components, Importance and Relevance
Positive and Negative Emotions
Healthy and Unhealthy expression of Emotions

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

Dressler, David and Cans, Donald: The Study of Human Interaction
Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company

FRENCH - I

Course Code: BSB 144 **Credit Units: 02**

Course Objective:

To familiarize the students with the French language
with the phonetic system
with the syntax
with the manners
with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1, 2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical : Unité 1: Découvrir la langue française : (oral et écrit)
se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
dire/interroger si on comprend
Nommer les choses

Unité 2: Faire connaissance
donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3 : Organiser son temps
dire la date et l'heure

Contenu grammatical :
1. organisation générale de la grammaire
article indéfini, défini, contracté
nom, adjectif, masculin, féminin, singulier et pluriel
négation avec « de », "moi aussi", "moi non plus"
interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
Interro-négatif : réponses : oui, si, non
pronom tonique/disjoint- pour insister après une préposition
futur proche

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

le livre à suivre : Campus: Tome 1

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BSB 201 **Credit Units: 03**

Course Objective:

Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Course Contents:

Module I: Nature of Biological materials
carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules
Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic
Laws of thermodynamics (1^{st} & 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body
Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments
Electricity as a potential signal**,** Neurotrasmitters, Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Outline of Biochemistry, Conn & Stumph
Fundamentals of Biochemistry, J.L. Jain
Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:
Textbook of Biochemistry, Lehninger
Biochemistry, L. Stryer, W.H. Freeman and Company
Instant notes in Biochemistry, Hames & Hooper
Anatomy and Physiology – Tortora & Grabowski
Biochemistry - Voet & Voit

BIOANALYTICAL TECHNIQUES

Course Code: **BSB 202** **Credit Units: 03**

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Course Contents:

Module I: Instruments, basic principles and usage

pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques

Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis

Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker

Bioinstrumentation, Webster

References:

Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic

Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press

Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.

NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.

Principles and Practice of Bioanalysis, Richard F. Venn

Microscopic Techniques in Biotechnology, Michael Hoppert

Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

Plant Sciences - II

Course Code: **BSB 203** **Credit Units: 03**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Course Contents:

GYMNOSPERMS

Module I
General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II
Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III
Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV
Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain, Rastogi Publication.

References:
Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
College Botary Vol.2, B.P. Pandey, S. Chand & Co.
Systematic Botany, S.C. Datta, New Age.
Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
Introductory Botany, A. Bendre & P. C. Pandey, Rastogi Publication.

Animal Sciences - II

Course Code: BSB 204 Credit Units: 03

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

Urochordata: Type Study of *Herdmania* (Including development)
Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
Petromyzon: External Features
Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

Integumentary system
Skeletal System: Girdles only
Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

Respiratory System
Circulatory System: Heart and Aortic Arches only
Nervous System; Brain only
Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

T. C. Majpuria. A text book of zoology.
V.K Tiwari, A Text book of Zoology
Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: **BSB 205** **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I
Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II
Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III
Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV
Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V
Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
A text book of Organic Chemistry, Bahl & Bahl, S. Chand & Co. Ltd.
Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.

References:
Advanced Organic Chemistry, Bahl & Bahl, S. Chand & Co. Ltd.
Organic Chemistry Vol.I & II, I.L. Finar
Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
Organic Chemistry Vol. I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.
Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
Atkin's Physical Chemistry, Atkin, Oxford Press.
Physical Chemistry, Vemulapalli, Printice Hall of India

ENVIRONMENT STUDIES

Course Code: BSB 206 Credit Units: 02

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV: Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

BIOTECHNOLOGY LAB – II
(BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: **BSB 220** **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: **BSB 221** **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH^{1+}, K^{1+}, CO^{2-}, S^{2-}, SO^{2-}, NO^{1-}, $CH\ COO^{1-}$, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO^{1-}, SO^{2-}, $C\ O^{2-}$, PO^{3-}, BO^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: **BSB 222** **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas*, *Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: **BSB 223** **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear

Different types of important edible fishes of India

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Development of chick up to formation of primitive streak

Module V: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: **BSB 241** **Credit Units: 01**

Course Objective:
The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:
Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication
Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation
Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills
Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills
Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays
Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya
Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:
Madhulika Jha, Echoes, Orient Long Man
Ramon & Prakash, Business Communication, Oxford.
Sydney Greenbaum Oxford English Grammar, Oxford.
Successful Communications, Malra Treece (Allyn and Bacon)
Effective Technical Communication, M. Ashraf Rizvi.

INDIVIDUAL, SOCIETY AND NATION

Course Code: **BSB 243** **Credit Units: 01**

Course Objective:

To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Thinking skills
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking

Module II: Hindrances to Problem Solving
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving Process
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
Convergent and Divergent thinking
Idea generation and evaluation (Brain Storming)
Image generation and evaluation
Debating
The six-phase model of Creative Thinking: ICEDIP model

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: **BSB 244** **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
To make them learn the basic rules of French Grammar.

Course Contents:

Module A : pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
rédiger un message/ une lettre pour …
prendre un rendez-vous/ accepter et confirmer/ annuler
inviter/accepter/refuser
Faire un programme d'activités
imaginer une conversation téléphonique/un dialogue
Propositions- interroger, répondre

Unité 4: Découvrir son environnement

situer un lieu
s'orienter, s'informer sur un itinéraire.
Chercher, décrire un logement
connaître les rythmes de la vie

Unité 5: s'informer

demander/donner des informations sur un emploi du temps passé.
donner une explication, exprimer le doute ou la certitude.
découvrir les relations entre les mots
savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
Adjectifs possessifs/exprimer la possession à l'aide de :
i. « de » ii. A+nom/pronom disjoint
Conjugaison pronominale – négative, interrogative - construction à l'infinitif
Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
passé composé
Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

GENETICS

Course Code: **BSB 301** **Credit Units: 03**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Course Contents:

Module I

Brief history, scope and significance of Genetics. Mendelian law of inheritance. Lethality and interaction of gene. Multiple allele and isoallele. Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II

Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV

Mutation; spontaneous and induced, Mutagen; chemical and physical. Chromosomal aberrations; structural and numerical. Economic importance of mutation. Genetic disorders in human; Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V

Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI

Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII

Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: **BSB 302** **Credit Units: 03**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery, origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I: History and development of microbiology
Introduction, contribution of Scientists (Leeuwenhoek, Pasteur, Koch etc.), role of microorganisms in transformation of organic matter and in the causation of diseases. Pasteur's experiments, concept of sterilization, microscopy (optical, TEM and SEM), concept of microbial species and strains; general outline of various forms of micro-organisms.

Module II: Ultra Structure of Prokaryotic cell
Nature of the microbial cell surface, Prokaryotic structure and function - cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions, gram positive and gram negative bacteria and endospores.

Module III
Nutritional classification of microorganisms, isolation of auxotrophs (replica plating), analysis of mutations in biochemical pathways, microbial assays for vitamins and antibiotics, strain improvement by selection.

Module IV: Control of microorganisms
Methods of sterilization & disinfection (Physical agents &chemical agents)Antibiotics with special reference to antibacterial & antifungal antibiotics, mode of actions,drug resistance .

Module V: Microbial agents of diseases
Clinically important Bacterial & fungal diseases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **BSB 303** **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper’s Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin’s Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

ANATOMY & PLANT PHYSIOLOGY

Course Code: **BSB 304** **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Course Contents:

Module I
Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviour of cambium in *Achyranthes*, *Boerhaavia*, *Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II
Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III
Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV
Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: **BSB 305** **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSB 306 **Credit Units: 03**

Course Objective:
The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I
Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II
General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III
Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV
Liquids: Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V
Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI
Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst's distribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III
(BASED ON GENETICS, MICROBIOLOGY, AND BIOCHEMISTRY AND METABOLIC REGULATION)

Course Code: **BSB 320** **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation

Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human

Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.

Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.

Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: **BSB 321** **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO $^{2+}$ as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: **BSB 322** **Credit Units: 01**

Course Contents:

Module I: Physiology

Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.

Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.

Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)

Experimentation- Separations of photosynthetic pigments by thin layer chromatography.

Respiration – Determination of R.Q.

Module II: Plant Anatomy

Anatomy of normal dicot and monocot roots, stems & leaves

Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSB 323 **Credit Units: 01**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

EFFECTIVE WRITTEN COMMUNICATION

Course Code: **BSB 341** **Credit Units: 01**

Course Objective:
To form written communication strategies necessary in the workplace

Course Contents:

Module I: Introduction to Writing Skills
Effective Writing Skills
Avoiding Common Errors
Paragraph Writing
Note Taking
Writing Assignments

Module II: Letter Writing
Types
Formats

Module III
Memo
Agenda and Minutes
Notice and Circulars

Module IV: Report Writing
Purpose and Scope of a Report
Fundamental Principles of Report Writing
Project Report Writing
Summer Internship Reports

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman –Prakash, Oxford
- Creative English for Communication, Krishnaswamy N, Macmillan
- Textbook of Business Communication, Ramaswami S, Macmillan
- Working in English, Jones, Cambridge
- A Writer's Workbook Fourth edition, Smoke, Cambridge
- Effective Writing, Withrow, Cambridge
- Writing Skills, Coe/Rycroft/Ernest, Cambridge
- Welcome!, Jones, Cambridge

PROBLEM SOLVING & CREATIVE THINKING

Course Code: **BSB 343** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Interpersonal communication and relationship.
Strategies for healthy interpersonal relationship
Effective management of emotions.
Building interpersonal competence.

Course Contents:

Module I: Interpersonal Communication
Importance of Behavioural/ Interpersonal Communication
Types – Self and Other Oriented
Rapport Building – NLP, Communication Mode
Steps to improve Interpersonal Communication

Module II: Interpersonal Styles
Transactional Analysis
Life Position/Script Analysis
Games Analysis
Interact ional and Transactional Styles
Bridging differences in Interpersonal Relationship through TA
Communication Styles

Module III: Conflict Management and Negotiation
Meaning and Nature of conflicts
Styles and techniques of conflict management
Meaning of Negotiation
Process and Strategies of Negotiation
Interpersonal Communication: Conflict Management and Negotiation

Module IV: Interpersonal Relationship Development
Importance of Interpersonal Relationships
Interpersonal Relationship Skills
Types of Interpersonal Relationships
Relevance of Interpersonal Communication in Relationship Development

Module V: Impression Management
Meaning & Components of Impression Management
Impression Management Techniques
Impression Management Training-Self help and Formal approaches

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.
- Rosenfeld, P., Giacalone, R.A. and Catherine, A.R. (2003). Impression Management: Building and Enhancing Reputations at Work. Thomson Learning, Singapore.

FRENCH - III

Course Code: **BSB 344** **Credit Units: 02**

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
caractériser une personne (aspect physique et caractère)

Contenu grammatical:

accord des adjectifs qualificatifs
articles partitifs
Négations avec de, ne…rien/personne/plus
Questions avec combien, quel…
expressions de la quantité
ne…plus/toujours - encore
pronoms compléments directs et indirects
accord du participe passé (auxiliaire « avoir ») avec l'objet direct
Impératif avec un pronom complément direct ou indirect
construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

TERM PAPER

Course Code: BSB 330 Credit Units: 02

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject. The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

Choosing a Subject

The subject chosen should not be too general.

Finding Sources of materials

The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.

Begin by making a list of subject-headings under which you might expect the subject to be listed.

The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

Get facts, not just opinions. Compare the facts with author's conclusion.

In research studies, notice the methods and procedures, results & conclusions.

Check cross references.

Outlining the paper

Review notes to find main sub-divisions of the subject.

Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the

following:

statement of purpose

main body of the paper

statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

Editing & Preparing the final Paper

Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.

Read the paper to ensure that the language is not awkward, and that it "flows" properly.

Check for proper spelling, phrasing and sentence construction.

Check for proper form on footnotes, quotes, and punctuation.

Check to see that quotations serve one of the following purposes:

Show evidence of what an author has said.

Avoid misrepresentation through restatement.

Save unnecessary writing when ideas have been well expressed by the original author.

Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

Title page

Acknowledgement

Abstract

Table of contents

Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?

Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?

Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?

Results (If any)

Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research

References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

File Specifications: The file should be submitted in plastic folder with following specifications:

A4 size paper
Font: Arial(10 pts) or Times New Roman(12pts)
Line Spacing(1.5)
Top & Bottom Margins 1 inch/2.5 cm
Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix
The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%
(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOINFORMATICS

Course Code: BSB 401 Credit Units: 03

Course Objective:

The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Course Contents:

Module I: Computers

General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics

Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases

Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification.

Module V: Genome analysis

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Computer Science, J.G. Brookshear, Pearson, Addison Wesley
Introduction to Bioinformation – T.Attawood

References:

A book on C by Kelley : Programming in C, Addison-Wesley Publishing
Introduction to C++ for Engineers and Scientists, Prentice-Hall
Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: **BSB 402** **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic informations are stored, expressed and transmitted among generations.

Course Contents:

Module I: Introduction to Moleculer Biology,

Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.

Molecular basis of life: DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.

Module II: Insertion elements, transposons and retrotransposons

Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.

Application of genetic engineering

Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes

Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.

Module III: Structure of prokaryotic and eukaryotic genes

Transcription mechanism in prokaryotes and eukaryotes.

Translation : Translation mechanisms in prokaryotes and eukaryotes.

Module IV: Gene Expression in prokaryotes

Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)

Module V: Eukaryotic gene Expression

Overview of gene expression, polyadenylation, cap formation, RNA degradation.

Module VI: Oncogenes and Tumor Suppressor genes

Oncogenes, tumor suppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Gene VIII, Benjamin Lewin 2005, Oxford University Press
Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing.

References:

Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
Genome, T.A. Brown, John Willey & Sons Inc.
Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY

Course Code: BSB 403 Credit Units: 03

Course Objective:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I
Historical perspective of immune system and immunity; Innate and specific immunity.

Module II
Humoral immunity and Clonal selection theory;

Module III
Cell-mediated immunity.

Module IV
The organs and cells of the immune system.

Module V
Histocompatibility: structure of MHC class I, II & III antigens & their mode of antigen presentation, MHC restriction; Antigens & antigenicity;

Module VI
Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:
Immunology, Roitt, Mosby – Yearbook Inc.
Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Course Contents:

Module I
Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.
Module II
Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding
Module III
General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.
Module IV
Economic importance with special reference to plants yielding:
Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
Common fibre yielding plants - Cotton, Jute .
Medicinal Plants – (*Papaver somniferum, and Atropa beladona.)*
Common timber yielding plants – *Dalbergia sisso, Tectona grandis.*

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
Economic Botany in the Tropics, S.L. Kochhar, Macmilian
Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand & Company Ltd.
Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:
Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: **BSB 405** **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals
General anatomy and physiology Pituitary,
General anatomy and physiology of Thyroid,
General anatomy and physiology Parathyroid,
General anatomy and physiology Pancreatic islets
General anatomy and physiology Adrenal

Module II: Excretory System:
General morphology and characteristics of Mammalian Kidney (Rabbit).
Structure & Function of Tubular reabsorption and Secretion.
Structure & Function of Nephron, Glomerular filtration.

Module III: Reproductive System:
Structure & Function of Testes & Ovary of Rabbit.
Spermatogenesis and its hormonal regulation
Oogenesis and its hormonal Regulation
Ovulation and fertilization

Module IV: Developmental Biology:
Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
Fertilization in mammals
Cleavage: types.
Formation of blastula in chick
Fate Map, Morphogenetic Movement & Gastrulation in Chick.
Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
T. C. Majpuria. A text book of zoology.
V.K Tiwari, A Text book of Zoology
Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: **BSB 406** **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic & non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates

Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II

General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III

General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV

Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

Module V: Chemical Thermodynamics

Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry

Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry

Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

A text book of Organic Chemistry, Bahl & Bahl, S. Chand & Co. Ltd.
Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.

References:

Advanced Organic Chemistry, Bahl & Bahl, S. Chand & Co. Ltd.
Organic Chemistry Vol. I & II, I.L. Finar
Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
Organic Chemistry Vol. I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.
Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY – IV LAB
(BASED ON BIOINFORMATICS, MOLECULAR CELL BIOLOGY, IMMUNOLOGY)

Course Code: BSB 420 Credit Units: 02

Course Contents:

Module I: Computers
Handling of computers and Data analysis using Oracle (create, append, delete, pack, display, list count, set, order, index, sort)

Module II: Bioinformatics
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.

Module III
Isolation of nuclear DNA (genomic & plasmid DNA)

Module IV
Blood film preparation & identification of blood cells
Study of blood groups
Study of ELISA.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSB 421 Credit Units: 01

Course Contents:

Module I: Embryology
Study of permanent slides of the:
T.S. anther, pollen, germinating pollen
L.S. ovule types
Endosperm
Embryos
L.S. caryopsis
Dissection of embryo

Module II: Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code: **BSB 422** **Credit Units: 01**

Study of permanent slides: **Endocrinae system**

T.S of Pituitary gland
T.S of Thyroid gland
T.S of Parathyroid gland
T.S of Pancreatic islets
T.S of Adrenal gland

Study of permanent slides: **Excretory System**

T.S of Kidney
T.S of Nephron
Estimation of Blood Urea, Bilirubin and Creatinine.

Study of permanent slides: **Reproductive System**

T.S of Ovary
T.S of Testes

Chick Embryology:

- Permanent slide of different steps of development of Chick embryo.
-Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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PROFESSIONAL COMMUNICATION FOR RECRUITMENT & EMPLOYABILITY

Course Code : BSB 441 **Credit Units: 01**

Course Objective:

To teach the participants strategies for improving academic reading and writing.
Emphasis is placed on increasing fluency, deepening vocabulary, and refining academic language proficiency.

Course Contents:

Module I: Social Communication Skills
Small Talk
Conversational English
Appropriateness
Building rapport

Module II: Context Based Speaking
In general situations
In specific professional situations
Discussion and associated vocabulary
Simulations/Role Play

Module III: Professional Skills
Presentations
Negotiations
Meetings
Telephony Skills

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

Essential Telephoning in English, Garside/Garside, Cambridge
Working in English, Jones, Cambridge
Business Communication, Raman –Prakash, Oxford
Speaking Personally, Porter-Ladousse, Cambridge
Speaking Effectively, Jermy Comfort, et.al, Cambridge
Business Communication, Raman –Prakash, Oxford

VALUES & ETHICS FOR PERSONAL & PROFESSIONAL DEVELOPMENT

Course Code: **BSB 443** **Credit Units: 01**

Course Objective:

To inculcate an elementary level of understanding of group/team functions
To develop team-spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation
Definition and Characteristics
Importance of groups
Classification of groups
Stages of group formation
Benefits of group formation

Module II: Group Functions
External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
Group Cohesiveness and Group Conflict
Adjustment in Groups

Module III: Teams
Meaning and nature of teams
External and Internal factors effecting team
Building Effective Teams
Consensus Building
Collaboration

Module IV: Leadership
Meaning, Nature and Functions
Self leadership
Leadership styles in organization
Leadership in Teams

Module V: Power to empower: Individual and Teams
Meaning and Nature
Types of power
Relevance in organization and Society

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

Organizational Behaviour, Davis, K.
Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - IV

Course Code: **BSB 444** **Credit Units: 02**

Course Objective:

To enable students:
To develop strategies of comprehension of texts of different origin
To present facts, projects, plans with precision

Course Contents:

Module C: pp. 104 – 139 : Unités 8,9

Contenu lexical : **Unité 8: Découvrir le passé**

parler du passé, des habitudes et des changements.
parler de la famille, raconter une suite d'événements/préciser leur date et leur durée.
connaître quelques moments de l'histoire

Unité 9: Entreprendre

faire un projet de la réalisation: (exprimer un besoin, préciser les étapes d'une réalisation)
parler d'une entreprise
parler du futur

Contenu grammatical:

1. Imparfait

Pronom « en »
Futur
Discours rapporté au présent
Passé récent
Présent progressif

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

le livre à suivre : Campus: Tome 1

PLANT BIOTECHNOLOGY

Course Code: **BSB 501** **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micropropagation.

Course Contents:

Module I: Introduction to in vitro methods
Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II: Introduction to the processes of embryogenesis and organogenesis and their practical applications
Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation
Principles of protoplast isolation and applications. Testing of viability of isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants
Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:
Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: BSB 502 Credit Units: 03

Course Objective:

The aim of the course is to provide equal importance to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I
Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines.

Module II
Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module III
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).

Module IV
Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Culture of Animal Cells, R.I Freshney, Wiley-Leiss.

References:
Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
Cell Culture Lab Fax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication.

IMMUNOTECHNOLOGY

Course Code: **BSB 503** **Credit Units: 02**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to mankind.

Course Contents:

Module I
Immunoglobulin gene: genetic basis of reation of antibody diversity; Effect of T cell functions.

Module II
Measurement of antigen – antibody interaction: agglutination, immunodiffusion, immuno-electrophoresis, ELISA, RIE, production of monoclonal antibodies.

Module III
Antibodies in targeting therapeutic agents.

Module IV: Hybridoma Technology
Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application

Module V
Tissue and organ transplant

Module VI
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination.
Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman.

References:
Immunology, Roitt, Mosby – Yearbook Inc.
Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company.
Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins.
Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

GENOMICS & PROTEOMICS

Course Code: **BSB 504** **Credit Units: 03**

Course Objective:
The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Course Contents:
GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome : 2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

Genes & Genomes, Maxine Singer and Paul Berg
Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
Genomes II, T.A. Brown
A Primer of Genome Science, Greg Gibson and Spencer V. Muse
DNA: Structure and Function, Richard R. Sinden
Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
Proteomics, T. Palzkill, Kluwer Academic Publishers
Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: **BSB 505** **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Course Contents:

Module I
Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II
Methods of DNA Introduction into living cells.

Module III
Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV
Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V
Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.
PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
Gene cloning and DNA analysis by T.A. Brown

References:

Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
DNA Science by Micklos Freyer
Principles of Gene manipulation and Genomics by Primrose and Twyman

MICROBIAL TECHNOLOGY

Course Code: **BSB 506** **Credit Units: 03**

Course Objective:

The basic knowledge of Microbiology gained in the previous semester would the applied in the various disciplines like evolution, Immunology & Industrial fermentation.

Course Contents:

Module I

Microbial nutrition and growth -The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module II

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module III

Host-parasite relationship (Normal micro flora of skin, oral cavity, gastrointestinal tract), types of toxins (Exo, endo, entero) and their structure and mode of actions, Microbe Interactions with other populations.

Module IV

Microbes in extreme environments: Archae as the earliest forms, thermophiles, pyshrophiles, halophiles, alkalophiles, acidophiles , hyperthermophiles.

Module V

Introduction to industrially important microbes and microbial fermentative products (Production of antibiotics with special refernce to peniciiin & streptomycin, enzymes, biotransformation of steroids), food products from microbes (Dairy &SCP etc)

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

The Microbial World, Roger Y. Stanier, Prentice Hall
Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
Industrial Microbiology, Casida, New Age International

BIOTECHNOLOGY LAB – V (BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BSB 520 **Credit Units: 02**

Course Contents:

Module I

Sterilization techniques of glass wares & equipment.
Preparation of cotton plugs & culture media.
Preparation and sterilization of different explants.
Inoculation of explants on culture media.

Module II

Culture of plant embryos/seeds. Callus culture, Testing of seed viability.

Module III

Culture of animal cell line. Preparation of competent cells by calcium chloride method.

Module IV

Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD & *E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BSB 521 **Credit Units: 02**

Course Contents:

Module I

Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II

Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III

Comparison of two given genomes- Mummer.

Module IV

Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

To enable the students to adopt strategies for effective reading and writing skills.

The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	Define Vocabulary Significance of Vocabulary One Word Substitution, Synonyms & Antonyms and Idioms & Phrases Define and Differentiate Homonyms, Homophones and Homographs Vocabulary Drills Foreign Words	
2.	**Module II Comprehension Skills**	**25% Weightage**
	Reading Comprehension-SQ3R Reading Techniques Summarising and Paraphrasing Précis Writing Listening Comprehension	
3.	**Module III Presentation Skills** Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** How Far is the River-Ruskin Bond My Wood-E.M.Forster I have a Dream-Martin Luther King Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.

Effective English for Engineering Students, B Cauveri, Macmillan India

***Creative English for Communication*, Krishnaswamy N, Macmillan**

Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan

AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**

Course Objective:

To inculcate in the students an elementary level of understanding of group/team functions .
To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation **(2 Hours)**

- Definition and Characteristics
- Importance of group
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions **(2 Hours)**

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams **(2 Hours)**

Meaning and nature of teams
External and internal factors effecting team
Building Effective Teams
Consensus Building
Collaboration

Module IV: Leadership **(2 Hours)**

Meaning, Nature and Functions • Self leadership
Leadership styles in organization •Leadership in Teams

Module V: Power to empower: Individual and Teams **(2 Hours)**

Meaning and Nature
Types of power
Relevance in organization and Society

Student learning outcomes

- Students will develop critical and reflective thinking abilities
- Students will demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will develop strategies to recruit, retain, and continually motivate contributing members to the organization.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

Organizational Behaviour, Davis, K.
Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers •Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour •Dressers, David and Cans, Donald: The Study of Human Interaction
Lapiere, Richard. T – Social Change
Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers.

Français-V

Course Code: FLU544 **Credit units: 02**

Course Objective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations, etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

Course Contents:

Dossier8Pg7584Dossiers4,5 and6(révision) Dossier8:Vivre ensemble

ActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,

l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant, Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.

· Andant, Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:

· Girardeau, Brunoet NellyMous.Réussirle DELFA1.Paris

SUMMER TRAINING

Course Code: BSB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of Summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

A short account of the activities that were undertaken as part of the project;
A statement about the extent to which the project has achieved its stated goals.
A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

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This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

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The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
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1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

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Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

- This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BSB 601 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Course Contents:

Module I
Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II
Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III
Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV
Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V
Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code: BSB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Course Contents:

Module I

Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II

Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III

Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, SCP.

Module IV

Production of fermented dairy products

Module V

Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Industrial Microbiology – Cassida

References:

- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot & Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business.

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code: BSB 620 **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Social Communication

Course Code: BSB 641 Credit Units: 01

Course Objective:

To enhance the skills needed to work in an English-speaking global business environment.

Course Contents:

Module I: Business/Technical Language Development
Advanced Grammar: Syntax, Tenses, Voices
Advanced Vocabulary skills: Jargons, Terminology, Colloquialism
Individualised pronunciation practice

Module II: Social Communication
Building relationships through Communication
Communication, Culture and Context
Entertainment and Communication
Informal business/ Technical Communication

Module III: Business Communication
Reading Business/ Technical press
Listening to Business/ Technical reports (TV, radio)
Researching for Business /Technology

Module IV: Presentations
Planning and getting started
Design and layout of presentation
Information Packaging
Making the Presentation

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Vocabulary in Use: Advanced Mascull, Cambridge
- Business Communication, Raman –Prakash, Oxford
- Business Communications, Rodgers, Cambridge
- Working in English, Jones, Cambridge
- New International Business English, Jones/Alexander, Cambridge

STRESS AND COPING STRATEGIES

Course Code: **BSB 643** **Credit Units: 01**

Course Objective:

To develop an understanding the concept of stress its causes, symptoms and consequences.
To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress
Meaning & Nature
Characteristics
Types of stress

Module II: Stages and Models of Stress
Stages of stress
The physiology of stress
Stimulus-oriented approach.
Response-oriented approach.
The transactional and interactional model.
Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress
Personal
Organizational
Environmental

Module IV: Consequences of stress
Effect on behaviour and personality
Effect of stress on performance
Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management
Importance of stress management
Healthy and Unhealthy strategies
Peer group and social support
Happiness and well-being

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience
- Clegg, Brian; Instant Stress Management – Bring calm to your life now

FRENCH - VI

Course Code: **BSB 644** **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events ;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

PROJECT

Course Code: **BSB 660** **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

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3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

Master of Science (Biotechnology)

Programme Code: MSB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2017 - 19

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2017

PROGRAM OBJECTIVE

The objective of Masters Programme in Biotechnology of Amity University is to develop multifaceted academically excellent students in various areas of Biotechnology. The course also aims to enhance the knowledge gained by them in the undergraduate curriculum so as to make them competent for future, academic or industrial pursuits.

The subjects included in the course curriculum suffice for both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practicals conducted in well-equipped laboratories. Subjects like Cell Biology, Genetics, Enzymology, Microbiology, Plant Biotechnology, Animal Biotechnology, and Immunology have contents with molecular approach so as to fulfill the requirements of current research and developmental needs. Industry oriented subjects like bioprocess engineering, downstream processing is taught for imparting knowledge of biotechnological application in industry.

In addition, molecular biology and recombinant DNA Technology is taught at advanced levels as they form the core foundation of biotechnology and biotechnological processes.

Therefore the present postgraduate curriculum in Biotechnology is aimed to produce highly motivated challenging young biotechnologist to take our country on the path of Biotechnology revolution.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MSB101	Advanced Biochemistry	3	-	-	3	
MSB102	Advanced Microbial Technology	3	-	-	3	
MSB103	Biophysics & Bioanalytical Techniques	3	-	-	3	
MSB104	Advanced Cell Biology & Genetics	3	-	-	3	
MSB105	Advanced Biostatistics for Biologists	3	-	-	3	
MSB106	Computer Applications	3	-	-	3	
MSB120	Biochemistry Lab	-	-	4	2	
MSB121	Advance Microbial Technology Lab	-	-	2	1	
MSB122	Cell Biology & Genetics Lab	-	-	2	1	
MSB123	Computer Applications Lab	-	-	2	1	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB141	Advanced Communication	30	-	-	1	
MSB143	Self-Development for Interpersonal	30	-	-	1	
 MSB144 MSB145 MSB146 MSB147 MSB148	Foreign Language - I French German Spanish Japanese Chinese	30	-	-	2	

SECOND SEMESTER

Compulsory Courses:						
MSB201	Advanced Molecular Biology	4	-	-	4	
MSB202	Advances in Genetic Engineering	4	-	-	4	
MSB203	Bioprocess Technology	4	-	-	4	
MSB204	Advanced Genomics & Proteomics	4	-	-	4	
MSB205	Computational Biology	3	-	-	3	
MSB206	Environmental Biotechnology	3	-	-	3	
MSB220	Advanced Molecular Biology Lab	-	-	4	2	
MSB221	Genetic Engineering Lab	-	-	4	2	
MSB222	Bioprocess Technology Lab	-	-	4	2	
MSB223	Advanced Genomics & Proteomics Lab			2	1	
MSB224	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB241	Communicational for Employment	30	-	-	1	
MSB243	Conflict Resoultion and Management	30	-	-	1	
 MSB244 MSB245 MSB246 MSB247 MSB248	Foreign Language - II French German Spanish Japanese Chinese	30	-	-	2	

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SUMMER INTERNSHIP OF 09 -12 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MSB301	Advanced Immunology	3	-	-	3	
MSB302	Enzyme Technology	3	-	-	3	
MSB303	Drug Design & Development	3	-	-	3	
MSB304	Advanced Animal Biotechnology	3	-	-	3	
MSB305	Advanced Plant Biotechnology	3	-	-	3	
 MSB306 MSB307 MSB308 MSB309 MSB310 MSB311	**Elective (Select any One)** • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
MSB320	Advanced Immunology Lab	-	-	2	1	
MSB321	Enzyme Technology Lab	-	-	2	1	
MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
MSB350	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB341	Professional Communicational Skills	30	-	-	1	
MSB343	Professional Competencies & Career Development	30	-	-	1	
 MSB344 MSB345 MSB346 MSB347 MSB348	Foreign Language - III French German Spanish Japanese Chinese	30	-	-	2	

FOURTH SEMESTER

Compulsory Courses:						
MSB460	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

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Curriculum & Scheme of Examination
ADVANCED BIOCHEMISTRY

Course Code: MSB 101 Credit Units: 03

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Course Contents:

Module I

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module II: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module III: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module IV: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module V: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VI: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), Lubert Stryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: **MSB 102** **Credit Units: 03**

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Course Contents:

Module I: Introduction to microbiology

Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms

Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics

Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation. Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology

Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: **MSB 103** **Credit Units: 03**

Course Objective:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Course Contents:

Module I: Membrane Biophysics
Genesis of membrane potential in nerve & membrane, Nerst & Goldman equation, Patch Clamp and Voltage – Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**
- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: **MSB 104** **Credit Units: 03**

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and subcellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.

Extrachromosomal inheritance:, Mitocondrial and chloroplast genetic code

Chromosomal aberration and polyploidy

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage.

Population genetics- Hardy weinbergs selection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase, Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer**,** cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MSB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: **MSB 106** **Credit Units: 03**

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers

Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office

Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.

Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system

Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce

Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language

Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF .. ELSE statements – Looping concepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj & Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: MSB 120 Credit Units: 02

Course Contents:

Module I: Proteins
Identification of protein by Biuret test.
Quantitation of protein by Bradford method
Separation of proteins by SDS-PAGE

Module II: Enzyme
Enzyme activity study of serum alkaline phosphatase

Module III: Nucleic Acid
Biochemical estimation of DNA
Biochemical estimation of RNA
Separation of DNA on Agrose gel.

Module IV: Carbohydrate
Biochemical estimation of blood sugar

Module V: Lipids
Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ADVANCE MICROBIAL TECHNOLOGY LAB

Course Code: MSB 121 Credit Units: 01

Course Contents:

Module I
Aseptic techniques: preparation of culture media for cultivation of specific microorganism.
Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II
Biochemical test - Indole test. methyl red test. voges proskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III
Isolation of special microbes from environment by isolation and enrichment techniques
Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD
Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV
Antibiotic sensitivity test by disc diffusion assay

Module V
Biochemical and molecular characterization of micro organisms
Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: **MSB 122** **Credit Units: 01**

Course Contents:

Module I
Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II
Isolation of chloroplast from spinach and study of electron transport chain.

Module III
Isolation of mitochondria and study of electron transport chain.

Module IV
Study of apoptosis by TUNEL method.
Site directed mutagenesis
Mutation detection and analysis
Mitosis
Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: **MSB 123** **Credit Units: 01**

Course Contents:

Module I: Ms-Office
Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003
Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language
Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

ADVANCED COMMUNICATION

Course Code: **MSB 141** **Credit Units: 01**

Course Objective:

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: **MSB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MSB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1, 2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

1. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
   Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED MOLECULAR BIOLOGY

Course Code: **MSB 201** **Credit Units: 04**

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Course Contents:

Module I: DNA replication and repair
DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA
Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA
Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation
Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; inhibitors, post translation modification of protein.

Module V: Regulation of gene expression
Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing
RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme
Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: **MSB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes. Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: **MSB 203** **Credit Units: 04**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: MSB 204 Credit Units: 04

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

PART I: GENOMICS

Module I
Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II
Transcriptomics and metatranscriptomics: Introduction , method and uses. genetic mapping

Module III
Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV
Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V
Introduction to proteomics
Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI
Post translational protein modification

Module VII
Protein – protein interaction some examples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: **MSB 205** **Credit Units: 03**

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

1. Major information Resources & Databases in Bioinformatics
   a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
   b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
   c. Derived (Secondry) Databases of Sequences and structure:
      i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
      ii. SCOP, CATH, DSSP, FSSP, RNAbase,
   d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
2. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
3. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
4. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
5. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
6. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
7. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)
Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.
Suffix tree and its applications in Bioinformatics
Gene Indentification Methods
Predictive Methods using DNA and Protein sequences.
Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.
Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.
Phylogenetics analysis software.
Molecular Structure drawing tool.
Molecular modeling/Docking.
Application of computational biology/Bioinformatics in Agriculture, Human health, Environment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MSB 206** **Credit Units: 03**

Course Objective:

The objective of this course is to familiarize the students with the processes and micro organism that can be employed for a cleaner environment. The students will be applying basic knowledge of microbiology for developing the practices for a cleaner environment, water, fuel, fertilizer, pesticides etc. The course also aims to make the students aware of legislation and acts prevalent to control the degradation of our eco system.

Course Contents:

Module I

Treatment of municipal wastes and industrial effluents (Physico-Chemical, biological analysis of waste water), Rr. Sec and test waste water treatment sludge treatment and disposal treatment of wastes from paper, textile, dairy, petrochemical and pharmaceutical industry .

Module II

Bioremediation and phytoremediation of toxic compounds like pesticides, hydrocarbons, polymers, surfactants, biotransformation and bioaccumulation

Module III

Renewable and non-renewable energy resources, clean fuel technology, biofuels.

Module IV

Biofertilizers and biopesticides – a cleaner agricultural practice, concept of N_2 - fixation, azolla, cyanobacteria, Rhizobium and VAM as biofertilizers.

Module V

Biomining – microbe assisted microbial leaching, bioaccumulation and bio sorption
Biosensors and biomarkers for ecotoxicity measurement, EIA and Environmental audit.

Module VI

Principles in ecotoxicology; animal toxicity tests; statistical concepts of LD_{50}; dose-effect and dose response relationship; frequency response and cumulative response; Biological and chemical factors and influence toxicity; global dispersion of toxic substance; dispersion and circulating mechanisms of pollutants; Aquatic toxicity testes; statistical tests; response of planktons to toxicants; EC_{50};

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Introduction to Environmental Biotechnology, Milton Wainwright

***References*:**

- Waste Water Engineering, Metcalf and Eddy. Publisher: Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, Jonh F.T. Spencer
- Principles of Environmental Engineering, Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: **MSB 220** **Credit Units: 02**

Course Contents:

1. Isolation of genomic DNA from prokaryotic and Eukaryotes.
2. Isolation of plasmid.
3. Study of DNA protein interaction.
4. Study of in vitro transcription.
5. Study of DNA methylation.
6. Study of DNA repair mechanism.
7. Invitro study of translation

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: **MSB 221** **Credit Units: 02**

Course Contents:

1. Study of gene expression in E.coli.(GFP cloning).
2. Study of Southern Hybridization.
3. Study of RFLP/RAPD.
4. Study of Western blotting.
5. Study of restriction digestion.
6. Study of legation.
7. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: **MSB 222** **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: **MSB 223** **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II

PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF data using PDquest software

Module IV

Primer designing, Analysis of protein 3D structures and comparison,. Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: **MSB 224** **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MSB 241** **Credit Units: 01**

Course Objective:
To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: MSB 243 **Credit Units: 01**

Course Objective:
This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MSB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
3. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED IMMUNOLOGY

Course Code: **MSB 301** **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.

Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: **MSB 302** **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes
Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

DRUG DESIGN AND DEVELOPMENT

Course Code: MSB 303 Credit Units: 03

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

***References*:**

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: **MSB 304** **Credit Units: 03**

Course Objective:
It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Course Contents:

Module I
Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II
Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III
DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV
Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V
Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: **MSB 305** **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques

Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II

Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III

Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV

Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V

Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DELIVERY SYSTEMS

Course Code: **MSB 306** **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MSB 307** **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs**.**

Module IV
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14 Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: MSB 308 Credit Units: 03

Course Objective:
The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:
- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: **MSB 309** **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases. Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy**.**

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: **MSB 310** **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code : MSB 311 **Credit: 03**

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

1. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
2. Organizational Structure and management
3. Capital Management
4. Product innovation and management
5. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

1. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
2. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
3. Basics of material management

Module III

1. Kaizen { Continuous improvement in product and management }
2. Six Sigma
3. Biotech enterprises: Small, Medium and Large.
4. Quality control in Biotech industries.

Module IV

1. Government Regulations for Biotech product.
2. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
3. Business development for medical products.
4. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne & Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

.ADVANCED IMMUNOLOGY LAB

Course Code: MSB 320 **Credit Units: 01**

Course Contents:

1. Purification of immunoglobin G.
2. Study of antigen- antibody pattern (ODD).
3. Study of sandwich ELISA.
4. Study of haemeagglutination.
5. Study of immunoelectrophoresis.
6. Isolation and identification of rosette cells.
7. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ENZYME TECHNOLOGY LAB

Course Code: MSB 321 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: **MSB 322** **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

1. Histological study of important animal tissues.
2. Estimation of enzyme activity from animal tissues.
3. Study of toxicity on invitro model.
4. Culture and maintenance of animal cell lines.
5. Culture of chicken fibroblasts.
6. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

1. Tissue culture lab and organization. Sterilisation of glasswares, tools and equipments.
2. Preparation of stocks and media. Surface sterilization of various explants
3. ORGAN CULTURE
4. Cllus culture
5. Anther culture
6. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PROFESSIONAL COMMUNICATIONAL SKILLS

Course Code: **MSB 341** **Credit Units: 01**

Course Objective:
To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

Course Contents:

Module I: Mechanics and Semantics of Sentences
Writing effective sentences
Style and Structure

Module II: Developing writing skills
Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

Module III: Business Presentations
Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

LEADING THROUGH TEAMS

Course Code: **MSB 343** **Credit Units: 01**

Course Objective:

This course aims to enable students to:
Understand the concept and building of teams
Manage conflict and stress within team
Facilitate better team management and organizational effectiveness through universal human values.

Course Contents:

Module I: Teams: An Overview
Team Design Features: team vs. group
Effective Team Mission and Vision
Life Cycle of a Project Team
Rationale of a Team, Goal Analysis and Team Roles

Module II: Team & Sociometry
Patterns of Interaction in a Team
Sociometry: Method of studying attractions and repulsions in groups
Construction of sociogram for studying interpersonal relations in a Team

Module III: Team Building
Types and Development of Team Building
Stages of team growth
Team performance curve
Profiling your Team: Internal & External Dynamics
Team Strategies for organizational vision
Team communication

Module IV: Team Leadership & Conflict Management
Leadership styles in organizations
Self Authorized team leadership
Causes of team conflict
Conflict management strategies
Stress and Coping in teams

Module V: Global Teams and Universal Values
Management by values
Pragmatic spirituality in life and organization
Building global teams through universal human values
Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - III

Course Code: **MSB 344** **Credit Units: 02**

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

1. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
2. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
3. parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

1. maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
2. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
3. caractériser une personne (aspect physique et caractère)

Contenu grammatical:

1. accord des adjectifs qualificatifs
2. articles partitifs
3. Négations avec de, ne…rien/personne/plus
4. Questions avec combien, quel…
5. expressions de la quantité
6. ne…plus/toujours - encore
7. pronoms compléments directs et indirects
8. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
9. Impératif avec un pronom complément direct ou indirect
10. construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

SUMMER INTERNSHIP

Course Code: MSB 350 Credit Units: 12

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: MSB 460 Credit Units: 30

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY
MADHYA PRADESH

Master of Technology (Biotechnology)

Programme Code: MTB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2017 – 19

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2017

PROGRAMME OBJECTIVE

Biotechnology is the technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.The main objective of this programme is to provide a balanced and comprehensive knowledge of the basic as well as applied sciences related to Biotechnology that would enhance the basic aptitude of each student and prepare them to take up the challenges in the varied and multi-faceted applications of Biotechnology. It will empower the students with the latest tools, techniques and awareness in biotechnology and will facilitate comprehensive learning combining the scientific and technological aspects

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB101	Biochemistry & Metabolic Regulation	4	-	-	4	
MTB102	Advanced Microbial Technology	4	-	-	4	
MTB103	Instrumentation in Biotechnology	4	-	-	4	
MTB104	Bioinformatics	4	-	-	4	
MTB105	Advance Biostatistics for Biologists	3	-	-	3	
MTB120	Biochemistry Lab	-	-	4	2	
MTB121	Microbiology Lab	-	-	2	1	
MTB122	Instrumentation in Biotechnology Lab	-	-	2	1	
MTB123	Bioinformatics Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB141	Advanced Communication	30	-	-	1	
MTB143	Self-Development for Interpersonal Skills	30	-	-	1	
 MTB144 MTB145 MTB146 MTB147 MTB148	Foreign Language - I French German Spanish Japanese Chinese	30	-	-	2	

SECOND SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB201	Cell & Molecular Biology	4	-	-	4	
MTB202	Recombinant DNA Technology	4	-	-	4	
MTB203	Bioprocess Technology	4	-	-	4	
MTB204	Genomics & Proteomics	4	-	-	4	
MTB205	Pharmaceutical Biotechnology	3	-	-	3	
 MTB206 MTB207 MTB208 MTB209 MTB210 MTB211	**Elective-I (any one)** • Environmental Biotechnology • Biosensors • Artificial Neural Networks • Agriculture Biotechnology • Fundamentals of Computers & Programming in “C” • Bio-energy Engineering	3	-	-	3	
MTB220	Cell & Molecular Biology Lab	-	-	4	2	
MTB221	Recombinant DNA Technology Lab	-	-	4	2	
MTB222	Bioprocess Technology Lab	-	-	4	2	
MTB223	Genomics & Proteomics Lab	-	-	2	1	
	TOTAL				**29**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB241	Communicational for Employment	30	-	-	1	
MTB243	Conflict Resoultion and Management	30	-	-	1	
 MTB244 MTB245 MTB246 MTB247 MTB248	Foreign Language - II French German Spanish Japanese Chinese	30	-	-	2	

SUMMER PROJECT: 8 - 10 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MTB301	Immunology & Immunotechnology	4	-	-	4	
MTB302	Enzymology & Enzyme Technology	4	-	-	4	
MTB303	Drug Design & Development	4	-	-	4	
MTB304	Bioprocess Plant Design	3	-	-	3	
 MTB305 MTB306 MTB307 MTB308 MTB309 MTB310	**Elective - II (any one)** • Pollution Prevention Fundamentals • Drug Delivery Systems • IPR, Biosafety & Bioethics • Advanced Food Technology • Industrial Safety & Management • Advanced Animal & Plant Cell Technology	3	-	-	3	
MTB320	Immunology & Immunotechnology Lab	-	-	4	2	
MTB321	Enzymology & Enzyme Technology Lab	-	-	2	1	
MTB360	Summer Project (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB341	Professional Communicational Skills	30	-	-	1	
MTB343	Professional Competencies & Career Development	30	-	-	1	
 MTB344 MTB345 MTB346 MTB347 MTB348	Foreign Language - III French German Spanish Japanese Chinese	30	-	-	2	

FOURTH SEMESTER

Compulsory Courses:						
MTB460	Project (20-22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **MTB 101** **Credit Units: 04**

Course Objective:

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

Course Contents:

Module I
Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II
Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III: Modes of Regulation
Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways
Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation, Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Biochemistry by A. Lehninger revised by Nelson and Cox.
- Biochemistry by Mathews, Van Holde and Ahern. IIIrd Edition.

References:
- “Biochemistry” by White, Handler and R.B. Smith 7th Ed. 1983
- Biochemistry” by L.Stryer Third Edition.
- Biochemistry by Voet and Voet.
- Fundamentals of Biochemistry by Conn and Stumph.

ADVANCED MICROBIAL TECHNOLOGY

Course Code: **MTB 102** **Credit Units: 04**

Course Objective:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

Course Contents:

Module I

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

Module II

Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module III

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

Module IV

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

Module V

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill.
- Microbiology by Prescott.

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: **MTB 103** **Credit Units: 04**

Course Objective:

To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Course Contents:

Module I: Ultracentrifugation
Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

Module II: Gel electrophoresis
Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

Module III
TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

Module IV
UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.

Module V
Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Module VI
Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:
- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John Wiley and Sons Ltd.
- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

BIOINFORMATICS

Course Code: **MTB 104** **Credit Units: 04**

Course Objective:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Course Contents:

Module I: Introduction and overview

The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.

Module II

Exact string matching -classical comparison based methods, semi numerical string matching, suffix trees - construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison

Module III

Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.

Module IV

Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees , estimating the rate of change, likelihood and trees; analysis software.

Module V

Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformaticsby C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MTB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics
Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II
Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics
Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV
Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

BIOCHEMISTRY LAB

Course Code: **MTB 120** **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity

Module II: Nucleic Acid
Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel.
Carbohydrate: Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar
Lipids: Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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MICROBIOLOGY LAB

Course Code: **MTB 121** **Credit Units: 01**

Course Contents:

Module I
Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

Module II
Biochemical test – Indole test, methyl red test, voges proskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: **MTB 122** **Credit Units: 01**

Course Objective:
To demonstrate the techniques used in the biotechnology for purification, characterization and identification of the proteins and other biotechnologically important products

Course Contents:
Module I: Cell disruption techniques
homogenization, sonication
Module II
Centrifugation – low speed and high speed.
Module III: Spectrophotometer techniques
Visible and UV spectrophotometry
Module IV
Chromatography-ion exchange, gel filtration and affinity columns, fraction collection, monitoring UV absorbance. Applications in enzyme purification.
Module V
Techniques for removal of salt/solvent from a sample -desalting, dialysis, ultrafiltration, speedvac, lyophilization etc.
Module VI
Electrophoresis –1 D (Polyacryamide gel electrophoresis and agarose) and 2D. Isoelectric focusing.
Module VII
Polarization and fluorescence microscopy

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOINFORMATICS LAB

Course Code: **MTB 123** **Credit Units: 01**

Course Objective:
To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

Course Contents:
Module I
Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
Module II
Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment
Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
Module III
Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing
Module IV
Phylogenetic prediction and analysis
Module V
Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.
Module VI
Finding transcription regulatory signals

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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ADVANCED COMMUNICATION

Course Code: **MTB 141** **Credit Units: 01**

Course Objective:
The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: MTB 143 **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MTB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1 : Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

1. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
   Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

CELL AND MOLECULAR BIOLOGY

Course Code: **MTB 201** **Credit Units: 04**

Course Objective:

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

Course Contents:

Module I

Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.

Module II

Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.

Module III

Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.

Module IV: Replication

Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease.

Recombination & Repair: Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.

Module V

Transcription - RNA transcription and the proteins required for each step, maturation of the RNA transcript derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression

Module VI: Translation

Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Molecular Cell Biology by Bruce Albert
- Molecular Biology by Lodish Darnell and Baltimore
- Molecular Biology of the gene by Watson et al 4th ed.

References:

- Genes VIII by Benjamin Lewis
- Genetics by Ursula Goodenough
- Cytogenetics by l Garl P. Swanson, Mertz & Young
- Biochemistry by Stryer
- Genome by T.A. Brown, John Willey and Sons Inc.

RECOMBINANT DNA TECHNOLOGY

Course Code: **MTB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I
Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

Module II: Gene isolation
Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

Module III: Heterologous gene expression (bacteria and yeast)
Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

Module IV: Studying gene regulation and control
In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

Module V: Automation and robotic advances in RDT
DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation

Module VI: Laboratory, industrial and environmental applications of RDT
High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- "Gene Expression Technology" by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- "DNA Cloning: A Practical Approach" by D.M. Glover and B.D. Hames, IRL Press.

BIOPROCESS TECHNOLOGY

Course Code: MTB 203 Credit Units: 04

Course Objective:

The present course aims to aware about the requirements for large-scale cultivation of microbes for production of industrially important products with purification and characterization of these bioproducts using different techniques

Course Contents:

Module I

Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch.

Module II

Substrates for bioconversion processes and design of media, sterilization; Cell culture techniques; Inoculum development and aseptic transfers. Bioreactors – CSTR, CSTR in series , tower, loops, airlift bubble column & packed bed. Different types of pumps, valves, and line materials, piping convections etc. used in Biochemical Processes

Module III

Process technology for the production of primary metabolites, e.g. Baker's yeast, ethanol, citric acid, amino acids (lysine and glutamic acid). Microbial production of industrial enzymes (glucose isomerase, cellulase, amylase, lipase, protease) and secondary metabolites (penicillins, cephalosporins and streptomycin). Biomass (SCP and mushroom) production from agro-residues.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition , uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery , uses of various forms etc.

Streptomycin – chemical structure, production, harvest and recovery, use, by-product of streptomycin fermentation etc.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Glutamic Acid: Direct Fermentation, contribution of feed back control and regulation of cell permeability barrier for production.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Module IV

Characteristics of bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press.
- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
- Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, W.F. Veith, John Wiley and Sons Inc.
- Biochemical Engineering, S. Aiba, A.E. Humphrey and N.F. Millis, University of Tokyo Press.
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Process Engineering in Biotechnology, A.T. Jackson, Prentice Hall.
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering/ Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society.

GENOMICS AND PROTEOMICS

Course Code: **MTB 204** **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

GENOMICS

Module I: Introduction to Genomics
Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes
Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods.

Module III
Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module IV
Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.

Module V
Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.

Module VI
Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA : Structure and Function, Richard R. Sinden
- www.panimaText.com

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MTB 205** **Credit Units: 03**

Course Objective:
The main objectives are to cover representative pharmaceutical dosage forms, and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

Course Contents:

Module I
Introduction to Physical Pharmaceutics - Metrology and Calculations,

Module II
Molecular structure, properties and States of Matter, Solutions, Phase Equilibra, Micromeritic and Powder Rheology, Surface and Interfacial Phenomena, Dispersion Systems, Diffusion & Dissolution, Kinetics and drug stability, Viscosity & Rheology

Module III
Polymer Science and Applications, Formulations and Development, Packaging

Module IV
Introduction to Industrial Processing, Transport Phenomena (Fluid Flow, Heat Transfer and Mass Transfer)

Module V
Particulate Technology (Particle Size, Size reduction, Size Separation, Powder Flow and Compaction), Unit Operations (Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, and Drying)

Module VI
Materials of Pharmaceutical Plant Construction, Good Manufacturing Practice (GMP's) Guidelines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Bentley's Pharmaceutics by E A Rawlins
- Pharmaceutical Sciences by Remington

References:
- Physical Pharmacy by Alfred Martin.
- Cooper and Gunn's Tutorial Pharmacy

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MTB 206** **Credit Units: 03**

Course Objective:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I

Environmental components, Natural resources, Ecosystem and its diversity, Environmental pollution and its major impacts, Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Land degradation, Biomagnification

Module II

Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III

Biodegradation and bioremediation of major pollutants, Biomineralisation: Use of microbial technology for mining

Module IV

Waste water engineering: Treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V

Bioassessment of environmental quality: Biosensors and biomarkers, Biofertilizers, Biopesticides and Vermi composting

Module VI

Environmental impact assessment and Environmental audit, Related case studies from Indian market

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

BIOSENSORS

Course Code: MTB 207 Credit Units: 03

Course Objective:

On completion of the module students should Be able to Appreciate the basic configuration and distinction among biosensor systems, To gain an understanding of general biosensor principles and terms, To be able to design, model, simulate, fabricate, and test a biosensor, To gain an overall knowledge of biosensor types, applications, requirements, and capabilities to allow improved interaction with physicians, clinicians, and biomedical engineers, and to enable the student to conduct biomedical engineering research.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and transducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Affinity Biosensors: Techniques and Protocol by K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applications by V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors by B.R. Eggins, John Wiley and Sons Inc.

References:

- Sensors and Sensing in Biology and Engineering by F.G. Barth, wt al, Springer Verlag.
- Biosensors by Minh Canh. Tran
- Biosensors: Theory and Applications by Donald G. Buerk
- Enzyme and Microbial Biosensors: : Techniques and Protocols - by Kim R. Rogers, Ashok Mulchandani
- Biosensors in Environmental Monitoring - by Ursula Bilitewski, Anthony P. F. Turner.
- Biosensors: Micro electrochemical Devices - by Marc J. C. Lambrechts
- Biosensors with Fiberoptics - by Donald Lee Wise, Lemuel B. Wingard
- Biosensors and Their Applications - by That Tjien Ngo, Victor Chi-Min Yang
- Thermal Biosensors, Bioactivity, Bioaffinity -by Prakash K. Bhatia
- Novel Approaches in Biosensors and Rapid Diagnostic Assays - by Zvi Liron, Avraham Bromberg, Morly Fisher
- Biosensors - by Anthony E. G. Cass.

ARTIFICIAL NEURAL NETWORKS

Course Code: **MTB 208** **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, besides the closely related aspects of artificial neural networks.

Course Contents:

Module I
Historical background, Why is learning hard?

Module II
Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multilayer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning.

Module III
The back propagation algorithm, Aspects of Learning Theory and Generalization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?.

Module IV
Neural networks and analog VLSI, Selected Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Neural Networks: A Comprehensive Foundation by S. Haykin, Prentice Hall.

References:

- Neutral Networks for Pattern Recognition by C. Bishop, Oxford University Press.

AGRICULTURE BIOTECHNOLOGY

Course Code: **MTB 209** **Credit Units: 03**

Course Objective:

This course is designed to cover key concepts in the structure and manipulation of DNA and inheritance of genes, traditional plant breeding, current impact of biotechnology on crop production and its commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation.

Course Contents:

Module I

Sterilization; Nutrient medium; Callus & Suspension culture; canning, regulation; Micropropagation, production of virus free plants, anther culture, pollen culture; ovary culture, homozygous lines; meristem culture; somatic hybridization, somaclonal variation, germplasm conservation

Module II

Genetic engineering in plants, direct and indirect method of plant cell transformation, vectors with special reference to Ti plasmids, selectable markers, mechanism of T-DNA transfer to plants, transgenic plants, molecular maps and gene tagging, marker assisted selection

Module III

Applications of genetic engineering, insect and pest resistance, herbicide resistance, cytoplasmic male sterility in plants, molecular farming.

Module IV

Plant patents, plant variety certificates, safety regulation in transgenic plants.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

FUNDAMENTALS OF COMPUTERS AND PROGRAMMING IN 'C'

Course Code: **MTB 210** **Credit Units: 03**

Course Objective:

The main objectives of the course are to demonstrate familiarity with computer, show understanding of computer hardware and software, display basic understanding of computer programming processes, develop understanding of computer file management and protection principles, explain Internet, LAN and digital media fundamentals, define information systems analysis and design concepts, identify and demonstrate use of database concepts.

Course Contents:

Module I
Introduction to Digital Computer: Major components of a Digital Computer - Number system - Binary codes - Fixed and Floating Point representation - Logic gates - Flip flops - Registers - Input and Output Devices.

Module II: Introduction to programming
Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program.

Module III: Data Types
Variables - Constants - Arithmetic expressions - Use of operators - program examples.

Module IV: Decision making in C
Relational operators - Logical operators - Precedence of operators - IF and IF ... ELSE statements – Looping concepts in C _ WHILE loop - DO ... WHILE and FOR loops - Programming examples.
Functions: User defined Functions - Local and Global variables - Parameters - Programming examples.

Module V: Arrays
BREAK statement - Strings and character arrays - examples.
Pointers: Concept of Pointers - The Indirection operator - Use of Pointers in arrays - Programming examples.

Module VI: Structures
The period operator - Arrays of structures - Arrays within structures - Structures within structures - Pointers to structures - The arrow operator - Programming examples.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamentals of Computers by V. Rajaraman
- C Programming" by G. Kochan

References:
- Computer Fundamentals by B. Ram.
- The Spirit of C" by Mullish Cooper.

BIO-ENERGY ENGINEERING

Course Code: **MTB 211** **Credit Units: 03**

Course Objective:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling.

Course Contents:

Module I: Biomass Sources, Characteristics & Preparation
Biomass Sources and Classification. – Chemical composition and properties of different biomass materials and bio-fuels – Sugar cane molasses and other sources for fermentation ethanol-Sources and processing of oils and fats for liquid fuels- Energy plantations
-Preparation of woody biomass: Size reduction, Briquetting of loose biomass, Drying, Storage and Handling of Biomass.

Module II: Biogas, Technology
Feedstock for biogas production, Aqueous wastes containing biodegradable organic matter, animal residues-. Microbial and biochemical aspects- Operating parameters for biogas production Kinetics and mechanism - Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.

Module III: Bio-Ethanol and Bio-Diesel Technology
Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

Module IV: Pyrolysis and Gasification of Biomass
Thermo-chemical conversion of ligno-cellulose biomass – Biomass processing for liquid fuel production - Pyrolysis of biomass-Pyrolysis regime, effect of particle size, temperature, and products obtained.
Thermo-chemical gasification principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidized Bed Gasifiers.

Module V: Combustion of Biomass and Cogeneration Systems
Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fuels from Biomass and Wastes by D.L. Klass and G.M. Emert, Ann Arbor Science pub. Inc. Michigan,
- Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes by A. Chakraverthy, Oxford & IBH publishing Co., New Delhi,

References:

- Biogas Systems: Principles and Applications by K.M. Mital, New Age International Publishers (p) Ltd.,
- Biomass Energy Systems, by P. Venkata Ramana and S.N. Srinivas, Tata Energy Research Institute, New Delhi, 1996.
- Bio-gas Technology by Khandelwal K.C. and Mahdi, Tata McGraw-Hill pub. Co. Ltd., New Delhi
- Advances in bio-gas Technology by O.P. Chawla, I.C.A.R., New Delhi. 1970.

CELL AND MOLECULAR BIOLOGY LAB

Course Code: **MTB 220** **Credit Units: 02**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

1. Isolation of genomic DNA from prokaryotic and Eukaryotes
2. Isolation of plasmid.
3. Study of apoptosis by TUNEL method
4. Isolation of cell organelles by ultracentrifugation.
5. Study of in vitro transcription.
6. Study of DNA repair mechanism
7. Site-directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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RECOMBINANT DNA TECHNOLOGY LAB

Course Code: **MTB 221** **Credit Units: 02**

Course Contents:

1. Preparation and Transformation of competent cells by CaCl2 method.
2. Restriction digestion
3. Legation
4. Southern hybridization
5. Western blotting
6. RFLP
7. PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOPROCESS TECHNOLOGY LAB

Course Code: MTB 222 Credit Units: 02

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

GENOMICS AND PROTEOMICS LAB

Course Code: MTB 223 Credit Units: 01

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Analysis of 2D – IEF data

Module IV

Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MTB 241** **Credit Units: 01**

Course Objective:

To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: MTB 243 **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MTB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
3. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: **MTB 301** **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I

Phylogeny of Immune System, Types of immunity clonal nature of immune response. Organization and structure of lymphoid organs. Antibody structure and function. Major histocompatibilty: Complex BCR and TCR, generation of antibody diversity, Complement system

Module II: Cells of the immune system

Hematopoiesis and differentiation, antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance.

Module III

Cell mediated toxicity, Hypersensitivity, Autoimmunity, Vaccines: General considerations, ideotype network hypothesis

Module IV

Tumor immunology, Transplantation immunology, Immunotheropy.

Module V

Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, (FACS) Hybridoma technology and its application

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Immunology by J. Kubey Fence Creek Publishing (Blackwell).
- Immunology by Ivan Riott

References:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: MTB 302 Credit Units: 04

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
General characteristics of enzymes, Mechanism of action of few enzymes: lysozyme, ribozymes, chymotrypsin and alcohol dehydrogenase.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Multisubstrate systems, Enzyme Inhibitors as therapeutic agents, active site, Isozyme and multienzyme complex.

Module III: Applications of enzymes
Clinical and Industrial, Enzyme Immobilization and its applications.

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice of reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies, Thermostable enzymes with special references to amylases, lipases and proteases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems by I.H. Segel, Wiley-Interscience
- Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis by R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis by R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer
- Industrial Enzymes & their applications by H. Uhlig, John Wiley and Sons Inc.

DRUG DESIGN AND DEVELOPMENT

Course Code: **MTB 303** **Credit Units: 04**

Course Objective:

The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research by J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action" by W.B. Pratt and P. Taylor, Churchill Livingston.

References:

- Principles of Medicinal Chemistry" by W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins.
- Side Effects and Drug Desig by E.J. Lien, Marcel Dekker
- The Anticancer Drugs by W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.

BIOPROCESS PLANT DESIGN

Course Code: MTB 304 Credit Units: 03

Course Objective:

The objective of this paper is to include the application of chemical engineering principles/unit operations to bioprocess systems and the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I
Introduction; general design information; Mass and energy balance.

Module II
Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment.

Module III
Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment.

Module IV
Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries.

Module V
Design of facilities for cleaning of process equipment used in biochemical industries.

Module VI
Utilities of biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Applied Process Design for Chemical and Petrochemical Plants by E.E. Ludwig, Butterworth-Heinemann.
- Chemical Engineering by R.K. Sinnott, J.M. Coulson and J.F. Richardson, Butterworth-Heinemann.

References:

- Chemical Engineers Handbook by R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling by F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers by M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design by E. Bausbacher and R. Hunt, Prentice Hall PTR.

POLLUTION PREVENTION FUNDAMENTALS

Course Code: **MTB 305** **Credit Units: 03**

Course Objective:

To develop an understanding of the methods and impacts of waste minimization including waste pollution prevention and recycling, obtain an overview of relevant environmental laws and regulations governing waste management, understand the phenomena and environmental impact of green-house gases and alternative energy sources to reduce the effect of global warming.

Course Contents:

Module I: Pollution Prevention in Industries
Environment friendly chemical processes-Properties and fates of environmental contaminants- Regulations for clean environment and implications for industries – Improved Manufacturing Operations.

Module II: Life Cycle Assessment and Environmental Audit
Life cycle assessment and pollution prevention economics-Hazard and risk Analysis - Pollution prevention planning - Design for the environment.

Module III: Conservation of Materials and Energy
Water energy and reagent conservation – Residuals management –
Economic Recovery and Recycling of Wastes - Case studies.

Module IV: Total Quality Environment Management and Ems 14000
Municipal pollution prevention programmes –Environment Management System-14000- Systematic, Structured and Documented Response to Environmental Issues- Auditable and Time Targeted Environmental Improvement Programs.

Module V: Hierarchy of Environment Management Practices
Waste-specific pollution prevention: waste pre - generation focus on minimization / recycling, Waste-specific pollution control treatment: pre – generation focus on disposal/ recycling- Waste-specific Post-release-to environment focus: recycling/ remediation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pollution Prevention: Fundamentals and Practice by Bishop P., McGraw-Hill International Edition, McGraw-Hill book Co, Singapore
- Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner,, Oxford University Press. N.Y.

References:

- Chemical Technology for better Environment by T.K. Roy, (Editor), Allied publishers Ltd, Chennai
- Pollution Prevention through Process Integration: Systematic Design Tools by El Halwagy, M.M, Academic Press, N.Y.

DRUG DELIVERY SYSTEMS

Course Code: MTB 306 Credit Units: 03

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MTB 307** **Credit Units: 03**

Course Objective:

The objectives of the course are to explain the fundamental principles of IPR issues and examine information policy issues from different perspectives. Students will study and assess policy groups, intellectual property rights, access to information and research policy issues that usually include plant, animal and microbial genetic engineering products

Course Contents:

Module I

Objectives of Intellectual Property Rights, origin and evolution of IPR, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Patent, Industrial Design, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties

Module II: IPR

National and international perspective, TRIPS and WIPO

Module III: Patent

Basic criterion for patentability, patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and international perspective, Case study: Basmati case, Neem controversy, Turmeric Case

Module IV: Biosafety

Definition and requirement; biosafety in relation to human health, environment, transgenic research and applications, biosafety laws, guidelines and conventions, biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule ; Regulation bodies at National and International level

Module V

Legal and socioeco'nomic impact of the products and techniques in Biotechnology, Bioethics in plant, animal and microbial genetic engineering, Ethical issues in healthcare, Biopiracy and ethical conflicts

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Coyles information highway handbook; A Practical File on the New Information Order, American Library Association, 2000.
- American Indian Cultural & Research Journal *(UCLA)*

References:

- Refer to Periodicals, Industry directories, Articles and report in journals on the regulatory issues, "Biotechnology" series by Rehm & Reed.

ADVANCED FOOD TECHNOLOGY

Course Code: **MTB 308** **Credit Units: 03**

Course Objective:

The purpose of the Food Technology major is to produce professionals with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research

Course Contents:

Module I

Processing and preservation technologies used in the food industry: heating, drying and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies

Module II

Micro-organisms and their metabolites for food, feed and fuel, development and application of food enzymes: fungal amylases, alpha-amylase, pectinase, amyloglucosidase and catalase. Technology for improvement of the quality of fruit juice through enzymatic treatment, Food spoilage and food poisoning micro-organisms

Module III

Pre- and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage

Module IV

Development of environment-friendly packaging materials based on product characteristics and performance properties of packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminium containers, and retortable pouches based on heat penetration studies and sterilization value

Module V

Food Safety in food service Establishment and other food areas

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Food Technology by Fraziar
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Evaluation Of Certain Food Additives And Contaminants, (WHO Technical Report Series 901) World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland
- International Journal of Food Science & Technology, Blackwell synergy publication
- Bioterrorism and Food Safety by Rasco and Bledsoe.

INDUSTRIAL SAFETY AND MANAGEMENT

Course Code: **MTB 309** **Credit Units: 03**

Course Objective:

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Course Contents:

Module I: Hazards

Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

Module II: Psychology and Hygiene

Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control

Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management

Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

Module V: Laws

Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S .Wood Wiley Interscience,

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

ADVANCED ANIMAL AND PLANT CELL TECHNOLOGY

Course Code: **MTB 310** **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

ADVANCED ANIMAL CELL TECHNOLOGY

Module I
Brief history of animal cell and organ culture, Cultivation of animal cell *en masse* in bioreactor, methods for scale-up, immobilized cell culture, insect cell culture, somatic cell culture, organ culture, and embryo culture.

Module II
Valuable products from cell culture, Production of recombinant tissue-plasminogen-activator, blood factor VIII, erythropoietin, insulin, somatostatin, somatotropin.

Module III
Hybridoma technology, Monoclonal antibodies- production and application, Stem cell technology, custom made animals and tissue engineering

ADVANCED PLANT CELL TECHNOLOGY

Module IV
Brief introduction to various tissue culture techniques,
Cell Cultures, regeneration and preservation: Plant regeneration through meristem, callus (somatic embryogenesis) and anthers. Protoplast culture and somatic hybridization. Production, preservation and use of somatic embryos. Artificial Seeds and Cybrids.

Module V
Induction & utilization of somatic variants; Secondary metabolite production through cell cultures. Principles and the technology, pharmaceutical, secondary metabolites & beverage production; Commercialization of tissue culture technology (Micropropagation). Plant cell reactors. Immobilized plant cell reactors

Module VI
Engineering of Chloroplast and mitochondrial genomes and their applications, Biotransformation by plant cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: MTB 320 Credit Units: 02

Course Objective:

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

Course Contents:

Module I

Blood film preparation and identification of cells, Identification of blood group, Isolation of serum.

Module II

Lymphoid organs and their microscopic organization.

Module III

WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test, ELISA:- DOT, SANDWICH

Module IV

Purification of IgG through affinity chromatography

Module V

Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code: MTB 321 Credit Units: 01

Course Objective:

To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells

Course Contents:

Module I

Isolation of Enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, acid phosphatase, cellulase, protease.

Module III

Production of enzyme on industrial scale using solid and liquid-state fermentation.

Module IV

Purification of enzyme by ammonium sulphate fractionation, ion-exchange, gel permeation chromatography.

Module V

Enzyme Kinetics: Determination of Michaelis-Menten constant (Km) and Maximum Velocity (Vmax), Temperature optima and pH optima of an enzyme.

Module VI

Enzyme immobilization and its effect on enzyme activity

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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PROFESSIONAL COMMUNICATIONAL SKILLS

Course Code: MTB 341 Credit Units: 01

Course Objective:

To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

Course Contents:

Module I: Mechanics and Semantics of Sentences
Writing effective sentences
Style and Structure

Module II: Developing writing skills
Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

Module III: Business Presentations
Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

LEADING THROUGH TEAMS

Course Code: MTB 343 Credit Units: 01

Course Objective:

This course aims to enable students to:
Understand the concept and building of teams
Manage conflict and stress within team
Facilitate better team management and organizational effectiveness through universal human values.

Course Contents:

Module I: Teams: An Overview
Team Design Features: team vs. group
Effective Team Mission and Vision
Life Cycle of a Project Team
Rationale of a Team, Goal Analysis and Team Roles

Module II: Team & Sociometry
Patterns of Interaction in a Team
Sociometry: Method of studying attractions and repulsions in groups
Construction of sociogram for studying interpersonal relations in a Team

Module III: Team Building
Types and Development of Team Building
Stages of team growth
Team performance curve
Profiling your Team: Internal & External Dynamics
Team Strategies for organizational vision
Team communication

Module IV: Team Leadership & Conflict Management
Leadership styles in organizations
Self Authorized team leadership
Causes of team conflict
Conflict management strategies
Stress and Coping in teams

Module V: Global Teams and Universal Values
Management by values
Pragmatic spirituality in life and organization
Building global teams through universal human values
Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - III

Course Code: **MTB 344** **Credit Units: 02**

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

1. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
2. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
3. parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

1. maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
2. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
3. caractériser une personne (aspect physique et caractère)

Contenu grammatical:

1. accord des adjectifs qualificatifs
2. articles partitifs
3. Négations avec de, ne…rien/personne/plus
4. Questions avec combien, quel…
5. expressions de la quantité
6. ne…plus/toujours - encore
7. pronoms compléments directs et indirects
8. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
9. Impératif avec un pronom complément direct ou indirect
10. construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

SUMMER PROJECT

Course Code: MTB 360 Credit Units: 12

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- ## Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- ## Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- ## Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- ## Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- ## Review of Literature and Definition of Problem

- ## Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article
Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.
For book:
Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

PROJECT

Course Code: MTB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor’s Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar’s signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:
For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Assessment Scheme:

Continuous Evaluation: 40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

AMITY UNIVERSITY
MADHYA PRADESH

Bachelor of Technology (Biotechnology)

Programme Code: BTB

Duration – 4 Years Full Time

Programme Structure

And
Curriculum & Scheme of Examination

Batch: 2018 – 2022

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
BTB 101	Applied Mathematics - I	3	1	-	4	
BTB 102	Applied Physics - I	2	1	-	3	
BTB 103	Applied Chemistry - I	2	1	-	3	
BTB 104	Introduction to Computers	2	1	-	3	
BTB 105	Life Sciences-I	2	1	-	3	
BTB 120	Applied Physics Lab - I	-	-	2	1	
BTB 121	Applied Chemistry Lab - I	-	-	2	1	
BTB 122	Programming in C Lab	-	-	2	1	
BTB 123	Engineering Graphics Lab	-	-	2	1	
BTB 142	Environmental Studies - I	2	-	-	2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BTB 141	English Langauge Usage Essentials	30	-	-		
BTB 143	Understanding Self For Effectiveness	30	-	-		
	Foreign Language - I	30	-	-		
BTB 144	French					
BTB 145	German					
BTB 146	Spanish					
BTB 147	Japanese					
BTB 148	Chinese					

SECOND SEMESTER

Compulsory Courses:						
BTB 201	Applied Mathematics – II	3	1	-	4	
BTB 202	Applied Physics - II	2	1	-	3	
BTB 203	Applied Chemistry – II	2	1	-	3	
BTB 204	Object Oriented Programming in C++	2	1	-	3	
BTB 205	Electrical Science	2	-	-	2	
BTB 206	Life Science-II	3	-	-	3	
BTB 220	Applied Physics Lab – II	-	-	2	1	
BTB 221	Applied Chemistry Lab - II	-	-	2	1	
BTB 222	Object Oriented Programming in C++ Lab	-	-	2	1	
BTB 223	Electrical Science Lab	-	-	2	1	
BTB 242	Environmental Studies - II	2			2	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BTB 241	Introduction to Communication Skill	30	-	-	1	
BTB 243	Individual, Society and Nation	30	-	-	1	
	Foreign Language – II	30	-	-	2	
BTB 244	French					
BTB 245	German					
BTB 246	Spanish					
BTB 247	Japanese					
BTB 248	Chinese					

V. dastav

TERM PAPER DURING SUMMER BREAK

THIRD SEMESTER

Compulsory Courses:						
BTB301	Cell Biology	3	-	-	3	
BTB302	Biochemistry - I	3	-	-	3	
BTB303	Microbiology	3	1	-	4	
BTB304	Molecular Biology	3	-	-	3	
CSE 202	Data StructuresThrough C++	3	-	-	3	
BTB320	Cell Biology Lab	-	-	2	1	
BTB321	Biochemistry Lab - I	-	-	2	1	
BTB322	Microbiology Lab	-	-	2	1	
BTB323	Molecular Biology Lab	-	-	2	1	
CSE 222	Data Structures Through C++ Lab	-	-	2	1	
BTB330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
‘BCU341	Communication Skill - III	30	-	-		
BSU 343	Behavioural Science - III	30	-	-		
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
BTB401	Biochemistry – II	3	1	-	4	
BTB402	Genetics	3	1	-	4	
BTB403	Methods & Instrumentation in Biotechnology	3	-	-	3	
BTB404	Chemical Biology	2	1	-	3	
CSE 304	Database Management Systems	3	-	-	3	
BTB420	Biochemistry Lab - II	-	-	2	1	
BTB421	Genetics Lab	-	-	2	1	
BTB422	Methods & Instrumentation in Biotechnology Lab	-	-	2	1	
CSE 324	Database Management Systems Lab	-	-	2	1	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BCU 441	Communication Skill - IV	30	-	-		
BSU 443	Behavioural Science - IV	30	-	-		
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT I – (6 - 8 WEEKS)

FIFTH SEMESTER

Compulsory Courses:						
BTB501	Plant Biotechnology	3	-	-	3	
BTB502	Animal Biotechnology	3	-	-	3	
BTB503	Structural Biology	3	-	-	3	
BTB504	Chemical Engineering Principles	3	-	-	3	
BTB505	Basic Bioanalytical Techniques	3	-	-	3	
CSE 403	Java Programming	3	-	-	3	
BTB520	Plant Biotechnology Lab	-	-	2	1	
BTB521	Animal Biotechnology Lab	-	-	2	1	
BTB522	Structural Biology Lab	-	-	2	1	
CSE 423	Java Programming Lab	-	-	4	2	
BTB560	Summer Project – I (Evaluation)	-	-	-	5	
	TOTAL				**28**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BCU 541	Communication Skill - V	30	-	-		
BSU 543	Behavioural Science - V	30	-	-		
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses:						
BTB601	Recombinant DNA Technology	3	-	-	3	
BTB602	Enzymology & Enzyme Technology	3	-	-	3	
BTB603	Immunology & Immunotechnology	3	1	-	4	
BTB604	Computational Biology	3	-	-	3	
BTB605	Fundamentals of Biochemical Engineering	3	-	-	3	
BTB620	Recombinant DNA Technology Lab	-	-	2	1	
BTB621	Enzymology & Enzyme Technology Lab	-	-	2	1	
BTB622	Immunology & Immunotechnolgy Lab	-	-	2	1	
BTB623	Computational Biology Lab	-	-	2	1	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BCU 641	Communication Skill - VI	30	-	-		
BSU 643	Behavioural Science - VI	30	-	-		
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT - II – (6 - 8 WEEKS)

SEVENTH SEMESTER

Compulsory Courses:						
BTB701	Bioprocess Technology	3	-	-	3	
BTB702	Downstream Processing	3	-	-	3	
BTB703	Statistics for Biology	3	-	-	3	
	Elective (Anyone of the following 8)	3	-	-	3	
BTB704	. Biosensors					
BTB705	• Thermodynamics of Biological Systems					
BTB706	• Pharmaceutical Chemistry & Drug Design					
BTB707	• Current Topics in Biotechnology					
BTB708	• Environmental Biotechnology					
BTB709	• Bioprocess Plant Design					
BTB710	• Artificial Neural Networks					
CSE 504	Advanced Java Programming	3	-	-	3	
BTB720	Bioprocess Technology Lab	-	-	2	1	
BTB721	Downstream Processing Lab	-	-	2	1	
CSE 524	Advanced Java Programming Lab	-	-	2	1	
BTB760	Summer Project - II (Evaluation)	-	-	-	6	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BCU 741	Communication Skill - VII	30	-	-	1	
BSU 743	Behavioural Science - VII	30	-	-	1	
	Foreign Language - VII	30	-	-	2	
FLU 744	French – VII					
FLU 745	German					
FLU 746	Spanish					
FLU 747	Japanese					
FLU 748	Chinese					

EIGHTH SEMESTER

Compulsory Courses:						
BTB801	Genomic & Proteomics	3	1	-	4	
BTB802	Drug Delivery Systems	3	-	-	3	
BCH 621	Management, Accounting & Cost Control	1	-	-	1	
BCH 622	Project Management	1	-	-	1	
BCH 623	Principles of Management & Enterprenurship Development	1	-	-	1	
CSE 804	ASP.NET	3	-	-	3	
BTB820	Genomic & Proteomics Lab	-	-	2	1	
CSE 824	ASP.NET	-	-	2	1	
BTB860	Major Project (10-12 Weeks)	-	-	-	16	
	TOTAL				**31**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BCU 841	Communication Skill - VIII	30	-	-		
BSU 843	Behavioural Science - VIII	30	-	-		
	Foreign Language -VIII	30	-	-		
FLU 844	French - VIII					
FLU 845	German					
FLU 846	Spanish					
FLU 847	Japanese					
FLU 848	Chinese					

Curriculum & Scheme of Examination

APPLIED MATHEMATICS – I

Course Code: BTB 101 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Differential Calculus
Derivative of a function, Derivatives at a point, Fundamental rules for differentiation: Product Rule, Quotient Rule and Chain Rule, Differentiation of Implicit Functions, Parametric forms and Logarithmic Differentiation, Successive differentiation, Leibnitz's theorem (without proof), Mean value theorem, Taylor's and Maclaurin's Theorem, Asymptote & Curvature, Partial Differentiation, Euler's Theorem, Maxima and Minima

Module II: Integral Calculus
Fundamental Integral Formulae, Methods of Integration: Integration by Substitution, By Parts, Partial Fractions, Definite Integral and its Properties, Reduction Formulae, Application to length, Area and Volume.

Module III: Ordinary Differential Equations
Definition of Order and Degree of differential equation, Formation of ODEs, Solution of Differential Equation of 1st Order and 1st Degree: Variable Separation, Homogeneous Differential Equations, Linear Differential Equations, Exact Differential Equations, General Linear ODE of Second Order, Solution of Homogeneous Equation, Solution of Simple Simultaneous ODE

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Differential Calculus by Shanti Narain
- Integral Calculus by Shanti Narain

References:
- Differential Equation by A.R.Forsyth
- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - I (FIELDS AND WAVES)

Course Code: BTB 102 **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I: Electrostatics

Brief introduction of Vectors, gradient of a scalar field, divergence and curl of vector field, Electric flux, Gauss's law, Statements of Gauss divergence and Stokes theorem

Module II: Relativity

Michelson-Morley experiment, Inertial & non-inertial frames, Special theory of Relativity, Relativistic space-time transformation, Transformation of velocity, Variation of mass with velocity, Mass-energy equivalence

Module III: Oscillations & Waves

Simple harmonic motion – equation and energy conservation, superposition of two SHMs, Lissajous figures, damped and forced oscillations – equations, amplitude and frequency response, LCR Circuit, resonance, sharpness of resonance, equation of motion for plane progressive waves, superposition of waves

Module IV: Wave Nature of Light

Interference: Conditions of interference, division of wavefront, Fresnel's biprism, division of amplitude, interference due to thin films, Newton's rings

Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, Transmission grating and its resolving power.

Polarization: Birefringence, Nicol prism, Production and analysis of plane, circularly and elliptically polarized light, Half and quarter wave plates, Optical rotation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Waves & oscillation, A. P. French
- Physics of waves, W. C. Elmore & M. A. Heald
- Introduction to Electrodynamics, D. J. Griffith
- Electrodynamics, Gupta, Kumar & Singh
- Optics, A. K. Ghatak
- Engineering Physics, Satya Prakash

APPLIED CHEMISTRY- I

Course Code: BTB 103 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Chemical Bonding
Types of bond: Ionic, Covalent and Co-ordinate bond; Fajan's rule; Hybridisation; H- bonding ; Valence bond and Molecular orbital theory for diatomic molecule.

Module II: Organic Mechanism
Electronegativity and dipole moment; Electron Displacement Effects: Inductive Effect; Mesomeric Effect; Electromeric Effects; Fission of covalent bonds; Intermediates of Organic reactions; Carbonium, Carbanion, Free Radical and Carbene; Types of organic reactions; Substitution, Elimination, Addition.

Module III: Instrumental method for Analysis
Introduction; Principles of spectroscopy; Law's of Absorbance; IR: Principle Instrumentation; Application; UV: Principle, Instrumentation and Application; NMR Principle and Instrumentation; Application; Chromatography; GC: Principle, Instrumentation and Application; HPLC: Principle, Instrumentation and Application.

Module IV: Thermodynamics
Introduction; Terminology; First Law; Heat Capacity; Calculation of thermodynamic quantities; Adiabatic and Isothermal Process; Reversible and Irreversible Process; Second law of Thermodynamics; Standard State; Gilbb's Helmholtz equation; VantHoff Isotherm and Isochore; Maxwell Relation; Third law of Thermodynamics; Chemical Potential; Activity and Activity Coefficient; Coupled Reactions.

Module V: Chemical Equilibrium
Introduction ; Le Chatelier's Principle; Equilibrium constant from Thermodynamic Constants; Acid-Base Concept; Weak acid and Weak base and their salts; Solubility Product; pH and pOH, Buffer Solution, Buffer Action.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Engineering Chmistry, Jain & Jain
- Engineering Chmistry, Shashi Chawla

References:
- Organic Mechanism, Morrison and Boyd
- Physical Chemistry, Puri Sharma and Pathania
- Organic Chemistry Vol-I, IL Finar
- Organic Chemistry Vol-II, IL Finar
- Physical Chemistry, Atkins Peter, Paula Julio
- A guide to mechanism in organic chemistry, Peter Sykes.
- Introduction to practical chemistry, K.K.Sharma
- Concise Inorganic chemistry, J.D. Lee

INTRODUCTION TO COMPUTERS

Course Code: BTB 104 **Credit Units: 03**

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction

Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types), H/W concepts (I/O Devices), S/W concepts (System S/W & Application S/W, utilities). Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C

History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Precedence of Arithmetic operators, Operator precedence of Arithmetic Operators, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C

C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types(automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions

One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations.
Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C

Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments.
Strings and C string library.
Structures and Unions. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments.
File Handling.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Yashwant Kanetkar, “Let us C”, BPB Publications, 2nd Edition, 2001.
- “ANSI C” by E Balagurusamy.
- Herbert Schildt, “C: The complete reference”, Osbourne Mcgraw Hill, 4th Edition, 2002.
- V.Raja Raman, “Computer Programming in C”, Prentice Hall of India, 1995.

***References*:**

- Kernighan & Ritchie, “C Programming Language”, The (Ansi C Version), PHI, 2nd Edition.
- J.B. Dixit, “Fundamentals of Computers and Programming in ‘C’.
- P.K. Sinha and Priti Sinha, “Computer Fundamentals”, BPB publication.

LIFE SCIENCES-I

Course Code: BTB 105 **Credit Units: 03**

Course Objective:

The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata and classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Invertebrates

Saileats features and outline classification of various phyla of invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II: Vertebrates

Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module-III: Lower Plants

Systematic: Recent trends in classification of Algae, Fungi, Bryophyte and Pteridophytes.
General account: Characteristic features; mode of reproduction and life cycles in Algae; Fungi including Lichens and Mycorrhiza; Bryophyte and Pteridophytes.
Economic Importance: Industrial applications; Ecological significance; Importance in agriculture.

Module-IV: Higher Plants

Systematics: Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority; Effective and valid publication; Author Citation. Broad outline of Bentham & Hooker, D.D Pant's classification
General account: General characteristic features, Distribution, mode of reproduction and generalised life cycles of Gymnosperms and Angiosperms.
Economic Importance: Industrial and ecological importance of Gymnosperms and Angiosperms

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Fundamentals of Environmental Chemistry, G.S.Sodhi, Narosa Publishers.
- Introduction to Environmental Pollution, B.K Sharma, H.Kaur, Goel Publishers.
- Biochemistry Styrier.
- Cell Biology, C B Pawar.
- Biochemistry, Lalinger.
- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain, Rastogi Publication.
- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.

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APPLIED PHYSICS LAB - I

Course Code: BTB 120 **Credit Units: 01**

List of Experiments

1. To determine the wavelength of sodium light by Newtons's rings method.
2. To determine the dispersive power of the material of prism with the help of a spectrometer.
3. To determine the specific rotation of sugar by Bi-quartz or Laurent half shade polarimeter.
4. To determine the speed of ultrasonic waves in liquid by diffraction method.
5. To determine the width of a narrow slit using diffraction phenomena.
6. To determine the temperature coefficient of platinum wire, using a platinum resistance thermometer and a Callender & Grif/fth's bridge.
7. To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
8. To determine the internal resistance of Leclanche cell with the help of Potentiometer.
9. To determine the resistance per unit length of a Carey Foster's bridge wire and also to find out the specific resistance of a given wire.
10. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.
11. To determine the value of acceleration due to gravity ("g") in the laboratory using bar pendulum.
12. To determine the moment of inertia of a flywheel about its own axis of rotation.
13. To determine the density of material of the given wire with the help of sonometer

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - I

Course Code: BTB 121 **Credit Units: 01**

List of Experiments

1. Titration of phosphoric acid and sodium hydroxide solution using pH meter.
2. Verification and application of Beer's Law.
3. Spectroscopic analysis of iron in water sample.
4. Conductometric titration.
5. Determination of water modules of crystallization in Mohr's salt.
6. (A) Determination of surface Tension of liquid.
   (B) Application of surface tension method in mixture analysis.
7. Application of distribution law in the determination of equilibrium constant.
8. Analysis of iron ore.
9. Plant pigments separation by paper chromatography.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

PROGRAMMING IN C LAB

Course Code: BTB 122 **Credit Units: 01**

Software Required: Turbo C

Course Contents:

Module I

DOS commands

Module II

Creation of batch files

Module III

C program involving problems like finding the nth value of cosine series, Fibonacci series etc.

Module IV

C programs including user defined function calls

Module V

C programs involving pointers, and solving various problems with the help of those.

Module VI

File handling

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ENGINEERING GRAPHICS LAB

Course Code: BTB 123 **Credit Units: 01**

Course Objective:

This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines

Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures

Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids

Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI: Development of Surface

Development of simple objects with and without sectioning. Isometric Projection

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

- M.B. Shah & B.C. Rana, Engineering Drawing, Pearson Education, 2007
- PS Gill, Engineering Drawing, Kataria Publication
- ND Bhatt, Engineering Drawing, Charotar publications
- N Sidheshwar, Engineering Drawing, Tata McGraw Hill
- CL tanta, Mechanical Drawing, “Dhanpat Rai”

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: BTB 141 **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication
Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation
Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills
Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills
Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays
Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya
Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

*** 30 hrs Programme to be continued for Full year**

ENVIRONMENTAL STUDIES - I

Course Code: BTB 142 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem

Structure and function of an ecosystem

Producers, consumers and decomposers

Energy flow in the ecosystem

Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

Biodiversity at global, national and local levels

India as a mega-diversity nation

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts

Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: BTB 143 **Credit Units: 01**

Course Objective:

This course aims at imparting:
Understanding self & process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effective on personality
Building Emotional Competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning and Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and nature of attitude
Components and Types of attitude
Importance and relevance of attitude

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, components, Importance and Relevance
Positive and Negative emotions
Healthy and Unhealthy expression of emotions

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - I

Course Code:BTB 144 **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

1. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
   Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

APPLIED MATHEMATICS – II

Course Code: BTB 201 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from athematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Linear Algebra

Definition of a Matrix, Operations on Matrices Determinants, Elementary Operations, Reduction of a Matrix to Row Echelon Form, Rank of a Matrix, Consistency of Linear Simultaneous Equations, Gauss Elimination and Gauss Jordan – Method, Eigen values and Eigen Vectors of Matrix, Caley-Hamilton theorem, Diagonalization of a matrix.

Module II: Complex Number

Definition of Complex Number, Equality, Conjugate and Modulus of a Complex Number, Polar form of a Complex Number, De-Moivre's Theorem, Roots of a Complex Number, Exponential and Circular function of a Complex Number, Hyperbolic Functions and their inverses.

Module III: Vector Calculus

Scalar and vector field, Gradient, Divergence and Curl, Directional Derivative, Evaluation of a Line Integral, Green's theorem in plain (without proof), Stoke's theorem (without proof) and Gauss Divergence theorem (without proof)

Module IV: Probability and Statistics

Frequency Distribution, Arithmetic Mean, Median, Partition Values, Mode, Variance and Standard Deviation, Curve Fitting, Principle of least squares, Linear regression.

Introduction to Probability, Addition and Multiplication theorem of Probability, Random variables and Probability Distribution,Expected values, Binomial distribution, Poisson distribution and Normal.

Distribution and their Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - II

Course Code: BTB 202 **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering.

Course Contents:

Module I: Wave Mechanics

de-Broglie matter waves, wave nature of particles, phase and group velocity, Heisenberg uncertainty principle, wave function and its physics interpretation, Operators, expectation values. Time dependent & time independent SchrÖdinger wave equation for free & bound states, square well potential (rigid wall), Concept of step potential.

Module II: Atomic Physics

Vector atom model, LS and j-j coupling, Zeeman effect & Paschen-Back effect, Bragg's law, X-ray spectra and energy level diagram, Laser – Einstein coefficient, population inversion, condition of light amplification, He-Ne and Ruby laser

Module III: Solid State Physics

Sommerfield's free electron theory of metals, Fermi energy, Energy bands in solids, physics of semi-conductors, doping, intrinsic and extrinsic semiconductors, Depletion layer, characteristics of PN junction, Forward and reverse baising, Breakdown voltage, Superconductivity, Meissner effect, Introduction to Nanomaterials

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Concept of Modern Physics, A. Beiser
- Applied Physics II, Agarawal & Goel
- Solid State Physics, S. O. Pallai
- Physics of Atom, Wehr & Richards

APPLIED CHEMISTRY - II

Course Code: BTB 203 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Water
Hardness of Water; Boiler Feed Water; Scale and Sludge; Softening of Water; External and Internal Treatment of Boiler Water; Domestic Water Treatment; Domestic Water Treatment; Desalination of Brackish Water; Chemical Analysis of Water; Dissolved O_2 (BOD, COD); Estimation of Free Chlorine; TDS.

Module II: Lubricants
Introduction; Mechanism of Lubrication; Types of Lubricants; Chemical structure related to Lubrication; Properties of lubricants; Viscosity and Viscosity Index; Iodine Value; Aniline Point; Emulsion number; Flash Point; Fire Point; Drop Point; Cloud Point; Pour Point. Selection of Lubricants.

Module III: Fuel
Introduction; Characteristics of good Fuel ; Calorific value; Bomb Calorimeter; Proximate and Ultimate analysis of coal; Carbonization of coal; Gasification and Liquification of coal: Fischer Tropsch and Bergius Process; Water Gas and Producer Gas

Module IV: Polymers
Introduction; Polymerization: Addition and Condensation Polymerization; Thermosetting and Thermoplastic Polymers; Molecular Weight of Polymer; Rubber, Plastic and Fiber; Preparation, Properties and uses of PMMA, Polyester, Epoxy Resins and Bakelite, Silicone Polymers.

Module V: Corrosion
Introduction, Mechanism of Dry and Wet Corrosion, Types of Corrosion, Galvanic Corrosion, Concentration Cell Corrosion, Passivity, Underground Soil Corrosion, Pitting Corrosion, Intergranular Corrosion, Waterline Influencing Corrosion, Corrosion Control.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Engineering Chemistry-Jain & Jain
- Engineering Chemistry- Shashi Chawla

References:
- Engineering Chemistry -Dara
- Engineering Chemistry -Sunita Ratan
- Polymer Science - Gowariker, Viswanathan Sreedhar
- Corrosion Engineering – Fontenna and Greene

OBJECT ORIENTED PROGRAMMING IN C++

Course Code: BTB 204 **Credit Units: 03**

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Course Contents:

Module I: Introduction

Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module II: Classes and Objects

Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module III: Inheritance

Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hiérarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module IV: Polymorphism

Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module V: Strings, Files and Exception Handling

Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997
- R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
- "Object Oriented Programming with C++" By E. Balagurusamy.
- Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.

References:

- Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
- Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
- Yashwant Kanethkar, "Object Oriented Programming using C++", BPB, 2004

ELECTRICAL SCIENCE

Course Code: BTB 205 **Credit Units: 02**

Course Objective:

The objective of the course is to provide a brief knowledge of Electrical Engineering to students of all disciplines. This Course includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of Transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Course Contents:

Module I: Basic Electrical Quantities

Basic Electrical definitions-Energy, Power, Charge, Current, Voltage, Electric Field Strength, Magnetic Flux Density, etc., Resistance, Inductance and Capacitance. Ideal Source, Independent Source and Controlled Source

Module II: Network Analysis Techniques & Theorems

Circuit Principles: Ohm's Law, Kirchoff's Current Law, Kirchoff's Voltage Law Network Reduction: Star–Delta Transformation, Source Transformation, Nodal Analysis, Loop analysis. Superposition theorem, Thevenin's Theorem, Norton's theorem and Reciprocity theorem.

Module III: Alternating Current Circuits

Peak, Average and RMS values for alternating currents, Power calculation: reactive power, active power, Complex power, power factor, impedance, reactance, conductance, susceptance Resonance: series Resonance, parallel resonance, basic definition of Q factor & Band-width.

Module IV: Transformers

Basic Transformer Operation principle, Construction, Voltage relations, current relations, Linear circuit models, open circuit test, short circuit test, Transformer Efficiency.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- R.J. Smith, R.C. Dorf: Circuits, devices and Systems
- B.L. Thareja: Electrical Technology : Part -1 & 2
- V.Deltoro: Electrical Engineering fundamentals
- Schaum's Series: Electrical Circuits

LIFE SCIENCES - II

Course Code: BTB 206 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. Moreover paper will provide knowledge of various physiological activities of higher plants which will help them to understand the various profiles of modern biotechnology.

Course Contents:

Module I: Anatomy & Physiology of Rabbit.

- Integumentary system
- Skeletal System: Girdles only
- Digestive system
- Respiratory System

Module II: Anatomy & Physiology of Rabbit.

- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Endocrine System
- Urinogenital System

Module-III Plant Physiology-I

Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration.

Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation; Plant Hormones.

Module-IV Plant Physiology-II

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

Respiration: Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
  Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.

APPLIED PHYSICS LAB - II

Course Code: BTB 220 **Credit Units: 01**

List of Experiments

1. To determine the wavelength of prominent lines of mercury spectrum using plane transmission grating.
2. To determine the thickness of a given wire by Wedge method.
3. To determine the wavelength of He-Ne laser light using single slit.
4. To determine the frequency of an electrically maintained tunning fork by Melde’s method.
5. To study the variation of magnetic field along the axis of Helmholtz coil and to find out reduction factor.
6. To draw the V – I characteristics of a forward and reverse bias PN junction diode.
7. To determine the frequency of AC mains using sonometer.
8. To determine the energy band-gap of Germanium crystal using four probes method.
9. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
10. To determine the acceleration due to gravity (“g”) using Keter’s reversible pendulum.
11. To study the characteristics of photo voltaic cell (Solar cell).

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - II

Course Code: BTB 221 **Credit Units: 01**

Course Contents:

1. Determining the viscosity index of lubricating oil by using Redwood viscometer.
2. Determining the flash point and fire point of lubricating oil.
3. Determination of Hardness of Water.
4. Chemical Analysis of Water like Alkalinity, residual Chlorine.
5. Synthesis of Urea Formaldehyde resin.
6. Determination of Molecular weight of Polymer.
7. Determination of Ion exchange capacity of a region.
8. Determination of dissolved Oxygen in Water.
9. Determination of Iodine value in water.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

OBJECT ORIENTED PROGRAMMING IN C++ LAB

Course Code: BTB 222 **Credit Units: 01**

Software Required: Turbo C++

- Creation of objects in programs and solving problems through them.
- Different use of private, public member variables and functions and friend functions.
- Use of constructors and destructors.
- Operator overloading
- Use of inheritance in and accessing objects of different derived classes.
- Polymorphism and virtual functions (using pointers).
- File handling.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ELECTRICAL SCIENCE LAB

Course Code: BTB 223 **Credit Units: 01**

List of Experiments

1. To verify KVL & KCL in the given network.
2. To verify Superposition Theorem.
3. To verify Maximum Power Transfer Theorem.
4. To verify Reciprocity Theorem.
5. To determine and verify RTh, VTh , RN , IN in a given network.
6. To perform open circuit & short circuit test on a single-phase transformer.
7. To study transient response of a given RLC Circuit.
8. To perform regulation, ratio & polarity test on a single-phase transformer.
9. To measure power & power factor in a three phase circuit by two wattmeter method.
10. To measure power & power factor in a three phase load using three ammeters & three voltmeter method.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: BTB 241 **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

ENVIRONMENTAL STUDIES - II

Course Code: BTB 242 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**EE**
Weightage (%)	15	5	5	5	70

INDIVIDUAL, SOCIETY AND NATION

Course Code: BTB 243 **Credit Units: 01**

Course Objective:

To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking
Thinking skills

Module II: Hindrances to Problem Solving Process
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation
Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

The six-phase model of Creative Thinking: ICEDIP model

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: BTB 244 **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
3. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

Unité 5 : s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

CELL BIOLOGY

Course Code: BTB 301 **Credit Units: 03**

Course Objective:

Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. It incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The object of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Course Contents:

Module I
The cell theory, pre cellular evolution, prokaryotic and eukaryotic cells.

Module II
Cell cycle - molecular events, cell division, mitosis and meiosis.

Module III
Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus,lysosomes, peroxisomes, golgi bodies, and transport across membranes.

Module IV
Cell locomotion- cytoskeleton, structure and function of cilia and flagella.

Module V
Cellular signaling –general mechanism of signaling and structures of the various types of receptors.

Module VI
Types of cancer, etiology of cancer, metastasis, cytological role of p53 and p21 genes in cancer development.

Module VII
Apoptosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmilian
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.

BIOCHEMISTRY - I

Course Code: BTB 302 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I
Introduction aims and scope
Chemical foundations of Biology -Properties of water, acids, bases and buffers, covalent bonds, Non-covalent interactions in biological systems.

Module II
Introduction to biomolecules - *Carbohydrates* -Sugars; Polysaccharides
Lipids -classification, structure and function. Lipids and biological membranes, Lipid linked proteins and lipoproteins, Atherosclerosis.

Module III
Metabolism and bioenergetics -First and second law, free energy and chemical equilibrium, Organic reaction mechanisms, Design of metabolism-concept of free energy, ATP-ADP cycle. Cellular energy transactions -role of mitochondria and chloroplast

Module IV
Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondrion and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module V
Lipid metabolism -Lipid digestion, absorption and transport, fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism. Cholesterol and Arachidonic Acid metabolism, Phospholipids, Sphingolipids and Glycolipids

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

MICROBIOLOGY

Course Code: BTB 303 **Credit Units: 04**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I

Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization,

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

MOLECULAR BIOLOGY

Course Code: BTB 304 **CreditUnits: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Course Contents:

Module I: DNA Replication and repair

Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication, DNA repair Mechanism.

Module II: Transcription

Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.

Module III: Modifications in RNA

5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

Module IV: Translation

Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.

Module V: Regulation of Gene Expression in prokaryotic and eukaryotic systems

Lac operon, Ara operan, regulation in Eukaryotes, Epigenetics.

Module VI: Antisense and Ribozyme technology

Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of Ribozyme; Hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense and ribozyme technologies.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing
- Gene VIII, Benjamin Lewin 2005, Oxford University Press

References:

- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.

DATA STRUCTURES THROUGH C++

Course Code: CSE 202 **CreditUnits: 03**

Course Objectives:

To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. To understand the notations used to analyze the Performance of algorithms. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations. To choose an appropriate data structure for a specified application. To understand and analyze various searching and sorting algorithms. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Course Contents:

Module I: Introduction to C++ (7 Hours)

C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers , friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism.

Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non Linear data structures.

Module II: Introduction to DS (6 Hours)

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular queues-Insertion and deletion operations.

Module III: TREES (6 Hours)

Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Minimum Spanning Tree: Prim's and Kruskal's Algorithm, Shortest Path Algorithms.

Module IV: SEARCHING & SORTING (5 Hours)

Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods.

Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.

Module V: GRAPHS(6 Hours)

Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis, Search Trees-Binary Search Tree ADT, Definition, Operations- Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees- Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.

Course Outcomes:

- Ability to choose appropriate data structures to represent data items in real world problems.
- Ability to analyze the time and space complexities of algorithms.
- Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Able to analyze and implement various kinds of searching and sorting techniques.

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference:

- Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

CELL BIOLOGY LAB

Course Code: BTB 320 **Credit Units: 01**

Course Contents:

Module I
Microscopy: Light microscopy, Bright field, Phase contrast & Gram's staining.

Module II
Study of chromoplasts, chloroplast in plant cell.

Module III: Cell Division
Mitosis and Meiosis

Module IV
Study of permanent slides of types of cancer

Module V
Study of apoptosis

Examination Scheme:

IA			EE			
ClassTest (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOCHEMISTRY LAB - I

Course Code:BTB 321 **Credit Units: 01**

Course Contents:

Module I
Colorimetric determination of pK.

Module II
Colour reactions of sugars. (Molischs test, iodine test, Saliwanoff test, Fehlings test, Benedicts test, Bials test).
Quantitative test for Carbohydrate & Protein.

Module III
Cholestrol estimation
Estimation of free fatty acids
Estimation of iodine number.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MICROBIOLOGY LAB

Course Code: BTB 322 **Credit Units: 01**

Course Contents:

1. Preparation of solid and liquid media.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution.
3. Preparation of slant cultures.
4. Growth curve measurement of bacterial population by turbidometry.
5. Measurement of bacterial population by dilution method.
6. Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.
7. Microscopic examination of bacteria by gram staining.
8. Endospore staining.
9. Capsule staining.
10. Isolation and identification of Rhizobium from root nodules.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MOLECULAR BIOLOGY LAB

Course Code: BTB 323 **Credit Units: 01**

Course Contents:

Module I
Preparation of DNA: genomic, Plasmid
Module II
Isolation of RNA
Module III
RFLP analysis
Module IV
Gel filtration
Module V
Preparation of Competent Cells
Module VI
Restriction Digestion and Ligation of DNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATA STRUCTURES THROUGH C++ LAB

Course Code: CSE 222 **CreditUnits: 01**
Total Hours : 20

Course Objectives:
To write and execute programs in C++ to solve problems using datastructures such as arrays, linked lists, stacks, queues, trees, graphs, hashtables and search trees.To write and execute write programs in C++ to implement various sortingand searching methods.

SOFTWARE REQUIREMENTS: Turbo C++ compiler or GCC compilers

List of experiments/demonstrations:

1. Write a C++ programs to implement recursive and nonrecursivei) Linear search ii) Binary search
2. Write a C++ programs to implement i) Bubble sort ii) Selectionsort iii) quick sort iv) insertion sort
3. Write a C++ programs to implement the following using an array.

a) Stack ADT b) Queue ADT

4. Write a C++ programs to implement list ADT to perform followingoperations
   a) Insert an element into a list.
   b) Delete an element from list
   c) Search for a key element in list
   d) count number of nodes in list

5. Write C++ programs to implement the following using a singly linked list. Stack ADT b) Queue ADT
6 Write C++ programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.
7. Write a C++ program to perform the following operations:
a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.
8 Write C++ programs for implementing the following sorting methods:
Merge sort b) Heap sort
9.Write C++ programs that use recursive functions to traverse the given binary tree in a) Preorder b) in order and c) post order
10 Write a C++ program to perform the following operations
a) Insertion into a B-tree b) Deletion from a B-tree

Course Outcomes:

- Ability to identify the appropriate data structure for given problem.
- Graduate able to design and analyze the time and space complexity ofalgorithm or program.
- Ability to effectively use compilers includes library functions, debuggersand trouble shooting.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and.Mount, Wiley student edition, John Wiley and Sons.
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:

To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin, indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.<u>Réussirle DELFA</u>

TERM PAPER

Course Code: BTB 330 **Credit Units: 02**

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.
The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
    (i) Show evidence of what an author has said.
    (ii) Avoid misrepresentation through restatement.
    (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure
It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References
From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[1] Pandian, P.S.,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C.” Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network” IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,”Clinical Decision Support System based Virtual Telemedicine”2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada “Intelligent Management of Processes in a ICU Telemedicine System” Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.
Appendix
The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.
Assessment Scheme:
Continuous Evaluation: 40%
(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)
Final Evaluation: 60%
(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOCHEMISTRY - II

Course Code: BTB 401 **Credit Units: 04**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Proteins -Amino acids and peptides - classification, chemical reactions and physical properties. Introduction to protein structure and function. Cis-trans peptide bond formation. Glycoproteins -structure and function, *Vitamins and Coenzymes*: structure and function of water soluble vitamins.

Enzymes -Introduction to kinetic and catalytic mechanisms of enzymes; Regulation of enzyme activity; Effects of physical parameters on enzyme activity, enzyme inhibitors – types of inhibition.

Module II

Nucleic acids - nitrogenous bases, nucleotides, types, structure and properties of nucleic acids

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, biosynthesis and breakdown of nutritionally non-essential amino acids (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine. Specialized Products of Amino Acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines, biosynthesis of nucleotide coenzymes (NAD, NADP, FAD, FMN; Catabolism of heam and clinical significance of bilirubin.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

GENETICS

Course Code: BTB 402 **Credit Units: 04**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.

Course Contents:

Module I

The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.

Module II: Mendelism

Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture.

Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.p

Module III

Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.

Module IV

Mutation and mutagenic agents, types of mutations, economic importance of mutation

Module V

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage

Module VI: Genetics of Population

Hardy- Weinburg Law and its deviations.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genetics, P.K. Gupta, Rastogi Publication
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

- Genetics, M.W. Strickberger, Prentice Hall College Division
- Genetics, P.J.Russell, Benjamin/Cummings
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.
- Genetics, R. Goodenough, International Thomson Publishing
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: BTB 403 **Credit Units: 03**

Course Objective:

The students will be exposed to techniques and instruments that are used in biotech industries.

Course Contents:

Module I: Electrophoresis

Agrose Gel electrophoresis, PAGE, SDS-PAGE, isoelectric focusing, two-dimensional electrophoresis, immuno electrophoresis, capillary electrophoresis

Module II: Chromatography

Paper, TLC, gel filtration, ion-exchange chromatography, affinity chromatography, HPLC and GLC

Module III: Spectroscopy

UV and visible spectroscopy ,Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Mass Spectrometry, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy,

Module IV

X-ray diffraction and X-ray Crystallography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wi

CHEMICAL BIOLOGY

Course Code: BTB 404 **Credit Units: 03**

Course Objective:

Chemical biology is that branch of life science, which deals with the study and manipulation of biological systems through the application of chemical techniques and tools. It differs from the more traditional disciplines of chemistry and biology in its emphasis on integrating a wider series of experimental techniques, ranging from synthetic organic chemistry, to biochemistry, to structural, molecular, and cellular biology. Chemical biology has historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry and metabolic engineering.

Course Contents:

Module I: Principles of chemical biology
Chemistry of carbohydrates, proteins and nucleic acids, strategies for identifying the cellular target of physiologically active natural products (paclitaxel, vancomycin), chemical aspects of signal transduction

Module II: Chemical reactions in living systems
Introduction to enzyme chemistry, Group transfer reactions, Substitutions, Carboxylation and decarboxylation, Isomerases, Eliminations and additions, Redox reactions (1), Redox reactions (2), Aldol and Claisen Reactions, One-carbon transfer reactions, Rearrangements

Module III: Structural chemical biology
Purine biosynthesis, polyamide biosynthesis, thiamine biosynthesis, vitamin E biosynthesis, proteases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Chemical Biology by H. Gobind Khorana
- Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH
- Foundations of Chemical Biology, C.M. Dobson, J.A. Gerrard, A.J. Pratt, Oxford Chemistry Primers
- Innovations in Chemical Biology, Sener Bilge, Springer
- Chemical biology by Stuart L. Shreiber, Tarun Kapoor, Gunther Wess, Wiley-VCH.

References:

- A General Method for Discovering Inhibitors of Protein−DNA Interactions Using Photonic Crystal Biosensors *Chem. Biol.*, 2008, *3* (7), pp 437–448.
- Optimization of non-natural nucleotides for selective incorporation opposite damaged DNA Org. Biomol. Chem., 2007, 5, 3623 – 3630.

DATABASE MANAGEMENT SYSTEMS

Course Code: CSE 304 **Credit Units: 03**

Course Objective:

The objective of this course is to get students familiar with Databases and their use. They can identify different types of available database model, concurrency techniques and new applications of the DBMS.

Course Contents:

Module I: Introduction (6 Hours)

Concept and goals of DBMS, Database Languages, Database Users, Database Abstraction.

Basic Concepts of ER Model, Relationship sets, Keys, Mapping, Design of ER Model, Concept of Generalization, Aggregation and Specialization. Transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model.

Module II: Relational Data models (6 Hours)

Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages:SQL-DDL, DML, integrity constraints, Complex queries, various joins, indexing, triggers,Relational algebra and relational calculus, Relational algebra operations like select, Project,Join, Division, outer union. Tuple relational calculus.

Module III: Data Base Design (6 Hours)

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies.

Module IV: Transaction Processing Concepts (6 Hours)

Transaction System, Testing of Serilizability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling.Concurrency Control Techniques: – Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction.

Module V: Relational Database Management Systems (6 Hours)

Study of Relational Database Management Systems through Oracle/Postgres SQL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi-threaded server, distributeddatabase. Introduction of ANSI SQL. Usage of like, any, all, exists, views and other commands, Special operators. Hierarchical queries, inline queries, flashback queries

Course Outcomes:

The student will learn

- Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
- Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
- Learn and apply structured query language (SQL) for database definition and database manipulation.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Korth, Silberschatz, "Database System Concepts", 4th Ed., TMH, 2000.
- Steve Bobrowski, "Oracle & Architecture", TMH, 2000

References:

- Date C. J., "An Introduction to Database Systems", 7th Ed., Narosa Publishing, 2004
- Elmsari and Navathe, "Fundamentals of Database Systems", 4th Ed., A. Wesley, 2004
- Ullman J. D., "Principles of Database Systems", 2nd Ed., Galgotia Publications, 1999.

BIOCHEMISTRY LAB - II

Course Code: BTB 420 **Credit Units: 01**

Course Contents:

Module I
Colour reactions of proteins (Ninhydrin test, Biuret test, Xanthoprotein test).
Estimation of proteins.
Module II
Biochemical estimation of DNA
Biochemical estimation of RNA
Quantitative determination of DNA and RNA by spectrophotometric method using UV range.
Determination of melting temperature of DNA from thermal denaturation characteristics.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS LAB

Course Code: BTB 421 **Credit Units: 01**

Course Contents:

1. Study of gene interaction.
2. Study of chromosomal translocation in Rhoeo discolor.
3. Study of bacterial conjugation.
4. Study of bacterial transduction.
5. Study of physical and chemical mutagens on growth of E. coli.
6. PTC test.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: **BTB 422** **Credit Units: 01**

Course Contents:

Module I
Cell disruption techniques

Module II
Centrifugation – low speed and high speed.

Module III
Spectrophotometer techniques

Module IV
Chromatography –Paper Chromatography and Thin Layer Chromatography

Module V
Electrophoresis –SDS Page and Agarose gel electrophoresis.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATABASE MANAGEMENT SYSTEMS LAB

Course Code: CSE 324 **Credit Units: 01**

Software Required: Oracle 9i **Total Hours: 20**

Topics covered in lab will include the following Programs:

1. Using create command design three specific table and the table structure is given below.

Table name- Book

ISBN	TITLE	PUB_YEAR	UNIT_PRICE	AUTHOR_NAME	PUB_NAME
1001	Oracle	2004	399	Arora	phi
1002	Dbms	2004	400	Basu	technical
2001	Dos	2003	250	Sinha	nirali
2002	Adbms	2004	450	Basu	technical
2003	Unix	2000	300	Kapoor	scitech

Table name- Author

AUTHOR_NAME	COUNTRY
Arora	U.S.A
Kapoor	Canada
Basu	India
Sinha	India

Table name- Publisher

PUB_NAME	PUB_ADD1
Phi	Delhi
Technical	Pune mainmarket
Nirali	Mumbai
Scitech	Chennai

2. Write the SQL query to find the name of all publisher from Book relation.
3. Write the SQL query to display the name of all publisher using distinct clause.
4. Write the SQL query to find the names of author from the author table where the first two characters of names are ‘ba’.
5. Write the SQL query to display title of books published in year 2004.
6. Write the SQL query to display title of books having price between 300 to 400.
7. Write the SQL query to display title of books having price between 300 to 400 using operators.
8. Write the SQL query to display title of books with author_name and country published in year 2004.
9. Write the SQL query to display all title and (unit_price*10) as an attribute from book table using arithmetic expression.
10. Write the SQL query to add the new column in all three tables.
11. Study the concept of Views and their utility in DBMS ,write the SQL query to design a view.
12. Write the SQL query to make the attribute ISBN as a primary key in Book relation.
13. Write the SQL query to display the all the titles of Books with price and year in descending order.
14. Write the SQL query to study the use of Delete and Drop command in DBMS.
15. Study the concept of Triggers, cursors and Stored procedures in DBMS.

Course Outcome:

- At the end of lab session students would be able to design the Database application for the real life projects.
- Students would be able to perform insertion, deletion and updation operation on Databases.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010. Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.***

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building- New-self awarness

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.
Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl'imparfait,comparer(nometverbe),qualifier(qui,que)s' exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. l'imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:

Text:

Le livre àsuivre:

Andant,Christineetal.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Andant,Christineetal.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,Brunoet NellyMous.<u>RéussirleDELFA1.</u>Paris: Didi

PLANT BIOTECHNOLOGY

Course Code: BTB 501 **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I

Historical perspective of plant tissue culture.
Tissue culture lab and organization
Sterilisation techniques
Types of nutrient media and media composition
Plant regeneration pathways
Role of phytohormones
Cell culture techniques- cell, tissue, organ cultures, callus culture, suspension culture
Culture techniques Callus culture, cell culture and protoplast cultures.

Module II

Organogenesis and somatic embryogenesis.
Applications of plant tissue and cell culture.
Micropopogation, pathogen free plants. production haploids,
Somaclonal variation.preservation of germplasm.

Module III

Genetic engineering in plants, - transformation vectors
Gene transfer techniques-vector meditated and vector less gene transfer.
Transgenic plants Tran's gene integration and expression

Module IV

Transgenic crop with new traits-herbicide tolerance, insect and disease resistance,
Therapeutic proteins and compounds
Oral vaccines
Production of secondary metabolites via tissue culture
Bioethics of plant genetic engineering.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: BTB 502 **Credit Units: 03**

Course Objective:

The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I

Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering.

Module II

Cell culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures

Module III

In vitro fertilization and embryo transfer

Module IV

Somatic cell hybridization, hybridoma technology

Module V

Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer

Module VI

Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc.

Module VII

Bioethical issues related to animal biotechnology,

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

STRUCTURAL BIOLOGY

Course Code: BTB 503 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

Course Contents:

Module I: Chemistry of amino acids and peptides

Side chain structure and function in protein folding and functionality: Secondary structure of proteins -helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Structure and function of an antibody; structure of hemoglobin, muscle proteins; Sequence and structural motifs in proteins.

Module II: Protein-ligand interactions

Lock and key versus handshake mechanism of substrate recognition; structural basis of recognition; reaction mechanisms of enzymes, G-Protein coupled receptors.

Module III: Protein solubility, protein stability and stabilization

Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding

Module IV: DNA structure

Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules -Rasmol, Deepview, Whatif.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemistry, R.H. Abeles, P.A. Frey and W.A. Jencks, Jones and Bartlett.
- Essentials of Molecular Biology, D. Freifelder, Jones and Bartlett Publications.
- Genes VII, B. Lewin, Oxford University Press.

References:

- Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company.
- Protein Structure, M. Perutz, Oxford University Press.
- Proteins (Structures and Molecular Properties), T.E. Creighton, W.H. Freeman and Company.
- Database Annotation in Molecular Biology, Arthur M. Lesk.
- From Genes to Clones, E.L. Winnacker.
- Genes & Genomes, M.S. Paul Berg.
- Structure and Machanism in Protein Science, Alan Fersht.

CHEMICAL ENGINEERING PRINCIPLES

Course Code: BTB 504 **Credit Units: 03**

Course Objective:

The knowledge gained through chemical reaction engineering and material and energy balances will help the students to understand the tools and techniques of biotechnology.

Course Contents:

Module I: Material and Energy Balances
Units and dimensions, Dimensional analysis; Simple problems on material balance calculations involving unit processes and reactive systems; Available electron balances.
Basic energy concepts -enthalpy changes in chemical/biochemical reactions and in non-reactive processes, Energy balance calculations, Use of Steam tables; Heat of reaction and energy balance for microbial processes.

Module II: Chemical reaction engineering
Kinetics of homogenous reactions: Concepts of reaction rate, order of reaction and molecularity, Analysis of batch reactors for kinetic interpretation of data and isothermal reactor design for single and multiple reactions, Design equations for CSTR and plug flow reactors.

Module III: Instrumentation and process control
Principles of measurement: error, accuracy and sensitivity; Measurement of flow, pressure, temperature, level, pH, viscosity and chemical composition.
Basic concepts of feedback control, control loop and its elements, Dynamic behaviour of first, second and higher order physical systems, controller hardware, choice of controllers and settings. Introduction to advanced control systems: feed forward, cascade and ratio control.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, Prentice Hall
- Basic Principles of Chemical Engineering, E.I. Shaheen, Houghton Mifflin

References:

- Chemical Process Control, An introduction to Theory and Practice, G. Stephanopoulos, Prentice Hall Inc.
- Chemical Reaction Engineering, O. Levenspiel, John Wiley and Sons Inc.
- Elementary Principles of Chemical Processes, R.M. Felder and R.W. Rousseau, John Wiley and Sons Inc.
- Fundamentals of Chemical Reaction Engineering, C.D. Holland and R.G. Anthony, Prentice Hall Inc.
- Process Modelling, Simulation and Control for Chemical Engineers, W.L. Luyben, McGraw Hill

BASIC BIOANALYTICAL TECHNIQUES

Course Code: BTB 505 **CreditUnits: 03**

Course Objective:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

Course Contents:

Module I: Solution and Buffers

Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.

Module II: Centrifugation

Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation.

Module III:Microscopy

Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy.
Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

Module IV: Radioisotope techniques

Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio – immunoassay.

Module V

Cell Disruption techniques, ultra filtration, dialysis and reverse osmosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

JAVA PROGRAMMING

Course Code: CSE 403 **CreditUnits: 3**
Total Hrs: 30

Course Objective:

The objective is to impart programming skills used in this object oriented language java.The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I(7 Hours)

Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison.Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays

Module II(7 Hours)

Classes and Objects in Java: Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces.Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages.

Module III(6 Hours)

Multithreaded Programming:Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication.Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.

Module IV(7 Hours)

GUI Programming -Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers, Swing Packages, Exploring Swing components ,Generating Swing Application

Module V(3 Hours)

Event Handling -The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events.

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH
- Introduction to JAVA Programming a primar, Balaguruswamy.

References:

- “Introduction to JAVA Programming” Daniel/Young PHI
- Jeff Frentzen and Sobotka, “Java Script” , Tata McGraw Hill,1999

Course Outcomes:

The student will learn

- Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- Students can demonstrate ability to implement multithreading in the programming.
- To learn syntax and features of exception handling
- Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings.
- To demonstrate the ability to handle Events in the Programming

PLANT BIOTECHNOLOGY LAB

Course Code: BTB 520 **Credit Units: 01**

Course Contents:

Module I
Sterilization of glasswares and equipments.
Preparation of cotton plugs and culture media
Preparation of stocks for culture media
Preparation of culture media

Module II
Preparation and sterilization of different explants
Inoculation of explants on culture media

Module III
Study of viability of seeds
Embryo culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL BIOTECHNOLOGY LAB

Course Code: BTB 521 **CreditUnits: 01**

Course Contents:

1. Preparation, standardization and sterilization of culture media
2. Inoculation of specific tissues for callusing
3. Inoculation and maintenance of cell lines
4. Study of toxicity on cell lines

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

STRUCTURAL BIOLOGY LAB

Course Code: BTB 522 **Credit Units: 01**

Course Contents:

1. Study of physical properties of proteins.
2. Analysis of protein structure.
3. Study of protein finger printing
4. Study of protein fractionation
5. Study of protein folding
6. Study of protein degadation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

JAVA PROGRAMMING LAB

Course Code: CSE 423 Credit Units: 2

Course Objective:

Programming in the Java programming language, knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

1. **Lab assignment will be based on the following: (40 Hours)**
    1. Use Eclipse or NetBeans platform and acquaint with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop. :**(2 Hours)**
    2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero. :**(2 Hours)**
    3. Develop an applet in Java that displays a simple message. :**(1 Hours)**
    4. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked. :**(1 Hours)**
    5. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 andNum2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box. :**(2 Hours)**
    6. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. :**(2 Hours)**
    7. Write a Java program that connects to a database using JDBC and does add, delete, modify and retrieve operations. :**(1 Hours)**
    8. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially there is no message shown. :**(1 Hours)**
    9. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape. : **(1 Hours)**
    10. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout. :**(2 Hours)**
    11. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes). :**(1 Hours)**
    12. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab. It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables). :**(1 Hours)**
    13. Implement the above program with database instead of a text file. :**(1 Hours)**
    14. Write a Java program that takes tab separated data (one record per line) from a text file and inserts them into a database. :**(1 Hours)**
    15. Write a java program that prints the meta-data of a given table. :**(1 Hours)**
2. **Students are required to develop anJAVA based application or model as project.**

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

- Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

Text:

- Java Fundamentals - A comprehensive Introduction, HerbetSchidt and Dale Srien, TMH.

References:

- Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI.
- Object Orientd Programming through Java, P. Radha Krishna, Universities Press.
- Thinking in Java, Bruce Eckel, Pearson Education
- Programming in Java, Bruce Eckel, Pearson Education
- Programming in Java, S. Malhotra and S. Choudhary, Oxford Univ. Press.

Course Outcome:

- knowledge of the structure and model of the Java programming language, (knowledge)
- use the Java programming language for various programming technologies (understanding)
- develop software in the Java programming language, (application)
- evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
- propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	• Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	
2.	**Module II Comprehension Skills**	**25% Weightage**
	• Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools.	
6.	**Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensemble

ActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,

l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

SUMMER PROJECT - I

Course Code: BTB 560 **Credit Units: 05**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

RECOMBINANT DNA TECHNOLOGY

Course Code: BTB 601 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I: Enzymes used in RDT

Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.

Module II: Cloning vectors

Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering

Module III: Blotting techniques and hybridization

Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.

Module IV: Nucleic acid amplification and its applications

Principles of PCR, designing of primers

Module V: Cloning Techniques

Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure , Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immunoscreening.

Module VI: DNA Libraries

Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries.

Module VII: Sequencing of DNA

DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor
- Laboratory Press.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: BTB 602 **Credit Units: 03**

Course Objective:
The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Michaelis Menten equation, Linear plots, King-Altman's method; Inhibitors and activators; Multisubstrate systems; ping-pong mechanism, Alberty equation, Sigmoidal kinetics and Allosteric enzymes

Module III
Immobilization of Enzymes; Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects.

Module IV: Enzyme reactors
Reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems, Mass transfer in enzyme reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reaction.

Module V: Bioprocess Design
Physical parameters, reactor operational stability, Immobilized cells.

Module VI: Challenges and future trends
Enzyme catalysis in organic media; catalytic antibodies and non protein biomolecules as catalysts, biocatalysts from extreme thermophilic and hyper thermophilic Archae and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.

References:
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner.
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience.
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: BTB 603 **Credit Units: 04**

Course Objective:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I: Introduction
Phylogeny of Immune System, Innate and acquired immunity, clonal nature of Immune Response.
Organization and structure of lymphoid organs Nature and Biology of antigens and super antigens Antibody structure and function; Types of immunity- innate, acquired, active and passive.
Module II: Major Histocompatibilty
MHC, BCR and TCR, generation of antibody diversity, Complement system
Module III: Cells of the immune system
Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T -Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells
Module IV: Regulation of immune response
Antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance
Module V: Cell mediated toxicity
Mechanism of T cell and NK cell mediated lysis and macrophage mediated cytotoxicity.
Module VI: Hypersensitivity
Module VII: Autoimmunity
Module VIII: Tumor immunology, Immunity to infectious agents
Module IX: Transplantation Immunology

Module X: Synthetic vaccines
Vaccines: General consideration, ideotype network hypothesis, Synthetic vaccines

Module XI: Hnmunological Techniques
Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter

Module XII: Hybridoma technology and its applications
Fusion of myeloma cells with lymphocytes

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

COMPUTATIONAL BIOLOGY

Course Code: BTB 604 **Credit Units: 03**

Course Objective:

The objective is to describe relational data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures genetic mapping etc.

Course Contents:

Module I: Introduction and overview

The NCBI data model; sequence databases, sequence retrieval, sequence file formats, submitting DNA and protein sequences.

Types of biological databases, Databases and rapid sequence analysis

Module II: Sequence alignment

Global and local alignments, statistical significance of alignments, scoring matrices and gap penalties, filtering, position specific scoring matrices, internet resources, Pairwise and multiple alignment, uses of pairwise and multiple sequence alignment, programs and methods for sequence alignment, pattern searching programs, family and superfamily representation, structural inference, dynamic programming algorithms, alignment by hidden Markov models, consensus word analysis, more complex scoring.

Module III: Phylogenetic prediction

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module IV: Predictive methods using DNA and protein sequences

ESTs – databases, clustering, gene discovery and identification, and functional classification.

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification;

Module V

Molecular modeling – PDB and MMDB, structure file formats, visualizing structural information, advance structure modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Molecular mechanics and dynamics, Docking of Molecules, Knowledge base structure prediction, Molecular Design, structure similarity searching; Secondary structure prediction in proteins, prediction of buried residues in proteins;

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F Quellette, Wiley – interscience.
- Bioinforamtics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. Von Heijne and G. Von Heijne, Academic Press.

FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Course Code: BTB 605 **Credit Units: 03**

Course Objective:

The course material on the kinetics of microbial growth, substrate utilization and product formation etc. may help the students to understand the various principles involved in instrumentation and control of bioprocess.

Learning outcome:

After successful completion of the course student will be able to:

- Learn the different phases of microbial growth, kinetics of substrate utilization and product formation.
- Understand various sterilization techniques and its principles.
- Familiarize themselves with the different parts, function and types of bioreactors and valves.
- Understand the mass transfer phenomenon, principles involved in instrumentation and control of bioprocess.

Course Contents:

Module I

Kinetics of microbial growth, substrate utilization and product formation.

Module II

Sterilization of air and medium.

Module III

Batch, continuous ,cell recycle and fed batch reactors; mass and energy balance in microbial processes, Bioreactor design, Different types of bioreactors, their parts and functions. Different types of valves.

Module IV

Mass transfer in Biological reactions; Scale-up principles; Instrumentation and control of bioprocesses.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Biochemical Engineering Fundamentals, J E Baily and D F Oillis, McGraw Hill
- Bioprocess Engineering Principles, P Doran, Academic Press

References:

- Chemical Engineering, J M Coulson, and J F Richardson, Butterwirth Heinemann
- Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, HC Vogel, CL Todaro, CC Todaro, Noyes Data Corporation/Noyes Publications
- Process Engineering in Biotechnology, A T Jackson, Prentice Hall

RECOMBINANT DNA TECHNOLOGY LAB

Course Code: BTB 620 **Credit Units: 01**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

Module I

Study of cloning (GFP CLONING)

Module II

Study of PCR

Module III

Study of Southern hybridiosation

Module IV

Study of RAPD

Module V

Site directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code:BTB 621 **CreditUnits: 01**

Course Objective:

The laboratory will help the students to isolate enzymes from different sources, enzyme assays and studying their kinetic parameters which have immense importance in industrial processes.

Course Contents:

Module I

Isolation of enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulase, protease.

Module III

Purification of Enzyme by ammonium sulphate fractionation.

Module IV

Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity, determination of Michaelis-Menten constant (K_m) and Maximum Velocity ($V_{max.}$) using Lineweaver-Burk plot.

Module V

Effect of Temperature and pH on enzyme activity.

Module VI

Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: BTB 622 **CreditUnits: 01**

Course Contents:

Module I
Blood film preparation and identification of cells.
Module II
Identification of blood group.
Module III
Isolation of serum.
Module IV
Lymphoid organs and their microscopic organization.
Module V
WIDAL Test
Module VI
Radial Immuno Diffusion Test
Module VII
Ouchterlony Double diffusion Test
Module VIII: Elisa
DOT, SANDWICH
Module IX
Purification of lgG through affinity chromatography
Module X
Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMPUTATIONAL BIOLOGY LAB

Course Code: BTB 623 **CreditUnits: 01**

Course Contents:

List of Experiments/Exercises.

1. Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
2. Local and Global Alignment- concepts Pair wise sequence alignment
3. Multiple sequence alignment
4. Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
5. Motif and pattern searching
6. Phylogentic prediction and analysis
7. Structure predicition
8. Finding transcription regulatory signals
9. Docking

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology).*Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: **FLU 644** **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

BIOPROCESS TECHNOLOGY

Course Code: BTB 701 **Credit Units: 03**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process

Module II

Process technology for the production of primary metabolites, eg. Biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides

Module III

Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture

Penicillin: Classification, various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc.

Streptomycin: chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc.

Tetracycline: chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.

Module IV

Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Bioprocess Engineering Principles, P Doran, Academic Press
- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press
- Process Engineering in Biotechnolgy, A T Jackson , Prentice Hall
-

DOWNSTREAM PROCESSING

Course Code: BTB 702 **Credit Units: 03**

Course Objective:

The syllabus will help the students to characterize the Bioproducts due to downstreaming process of biotechnological importance.

Course Contents:

Module I
Characteristics of Bioproducts; Coagulation, Flocculation and conditioning of broth.

Module II
Mechanical separation; Cell disruption techniques

Module III
Protein precipitation and separation

Module IV
Aqueous- two- phase extraction, Adsorption-desorption processes

Module V
Chromatographic methods of separation based on size, charge, hydrophobic interactions and biological affinity

Module VI
Membrane based separation; Dialysis, Electrodialysis; Micro filtration, Ultra filtration; Electrophoresis

Module VII
Crystallization; Drying

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill.
- Bioseparatioins, P.A. Belter, E.L. Cussler and W.S. Hu, John Wiley and Sons Inc.Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering / Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society.
- Protein Purification, M.R. Ladisch, R.C. Willson, C.C. Painton and S.E. Builder, American Chemical Society.

STATISTICS FOR BIOLOGY

Course Code: BTB 703 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice.

Course Contents:

Module I

Statistics and Biostatistics: Preliminary concepts.
Measures of Central Tendency: Mean, Median, Mode
Measures of Dispersion: Range, Standard deviation, Variance

Module II

Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.

Module III: Continuous Distribution

Normal Distribution, Properties of Normal distribution

Module IV: Correlation

Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, some examples.

Module V: Regression

Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples.
Method of least square: Fitting of straight line

Module VI: Introduction to the following Statistical terms

Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications.
Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test.
Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means.
Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity.
Analysis of Variance: One way and two way (only Examples)

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
- Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
- Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand & Co.

References:

- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons
- Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
- Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

BIOSENSORS

Course Code: BTB 704 **Credit Units: 03**

Course Objective:

The course aims at developing an understanding of Biosensor technology needed critically for the development of small, sensitive, and selective biosensor devices and detection systems that can reliably operate in real time and in extreme and diverse physical environments. Biosensors are important tools in food safety diagnostics, medical monitors, and detection systems for biological warfare agents.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and trnsducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Affinity Biosensors: Techniques and Protocols, K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applicatrions, V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors, B.R. Eggins, John Wiley and Sons Inc.
- Sensors and Sensing in Biology and Engineering, F.G. Barth, wt al, Springer Verlag.

THERMODYNAMICS OF BIOLOGICAL SYSTEMS

Course Code: **BTB 705** **Credit Units: 03**

Course Objective:

The main aim is to understand the basis of theories related to combustion and dissolution. It will help in the study of heat evolution, control of dissipation and will suggest ways for solving the rate phenomena through the dynamics of mass transfer applicable to biological process

Course Contents:

Module I
Energy, thermodynamics and living processes - an introduction

Module II
Energetic processes in the biosphere: The ecosystem.

Module III
Thermodynamics systems: equilibrium, activity coefficients and phase equilibrium functions of state, cyclic processes, work, energy and metabolic heat; Mechanical equivalent of heat, energy as a function of state.

Module IV: The laws of thermodynamics
Second law; Reversible vs. irreversible processes entropy, work; Combination of the first and second law, Free energy, useful work and delta G. Entropy: Ideality and Molecular Cohesion, Probabilistic nature of Entropy, Order and Disorder.

Module V: Biological systems as open, non-equilibrium systems
Failure of classical thermodynamics in describing biological processes, Standard free energy changes and equilibrium constants, direction and rate.

Module VI: Chemical potential
Visualization of the potential velocity and steady flow; Fick's law and diffusion. Local Equilibria and steady state: Energy vs. Power; Transducers in biological states, Constitutive equations, Dynamic efficiency and Onsager (nonequilibrium thermodynamics), Prigogine's principle, Spontaneous coupling and entropy production.

Module VII: Non-equilibrium thermodynamics
Reversible work, exact differentials and function of state, first and second law, The electrochemical potential, External forces an steady state, Fick's Law, chemical reactions in the steady state, internal entropy production, cells as non-equilibrium stationary states; Diffusion and membrane transport. Thermodynamic analysis of oxidative photophospghorylation, stability of non-equilibrium stationary states, ordering in time and space far from equilibrium, glycolytic oscillations, biological clocks, routes to chaos.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Bioenergetics, A.L. Lehninger, W.A. Benjamin Inc.
- Biological Thermodynamics, D.T. Haynie, Cambridge University Press.
- Biophysical Chemistry, C.R. Cantor and P.R. Schimmel, Freeman
- Physical Chemistry: Principles and Applications in Biological Sciences, I. Tincoco, K.Sauer and J.C. Wang, Prentice Hall College Division.
- Physical Chemistry for the Chemical and Biological Sciences, R. Chang, University Science Books
- Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, John Wiley and Sons Inc.

PHARMACEUTICAL CHEMISTRY AND DRUG DESIGN

Course Code: BTB 706 **Credit Units: 03**

Course Objective:

The main objective of this course is to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. The contents will introduce them to various drug molecules used in treatment, mitigation and cure of different disease. The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I

Introduction of pharmaceutical Chemistry, Overview of drug discovery process.

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action

Module II: Drug Targets and their validation

Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins

Validation Strategies

Module III: Drug Design Strategies

A. Structure-based design-Docking and denovo methods

B.Design and development of combinatorial libraries for new lead generation

The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemiometrics in drug design.

C. QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.

Module IV

Drug toxicity, tolerance, dependence, addiction, Dose Response curves

Module V

Survey of various Drug Classes – Anaesthetics (general, local), Analgescis, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids- Mechanism of action and applications

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press
- Pharmaceutical Dosage forms and Drug Delivery Systems, H.C. Ansel , L.V. Allen, N.G. Popovich, Lippincott Williams and Wilkins Publishers
- Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry, T.L. Lemke, Lea and Febiger

CURRENT TOPICS IN BIOTECHNOLOGY

Course Code: BTB 707 **Credit Units: 03**

Course Objective:

A complete understanding of the application of biotechnology in various fields can be understood by studying the various modules of this paper. Success of biotechnology depends largely on how it can be effectively utilized in finding solutions to many vexed problems of present day society. The objective of this paper is to familiarize the students with some of the frontier areas if biotechnological applications where a huge scope for further contributions for betterment of the society exists. The paper shall be a interface between the students and the social at large.

Course Contents:

Module I: Bioremediation

Introductory concept, Bioremediation principles, mechanism for Bioremediation of air, water and soil pollutants, bioremediation examples, commercial application of bioremediation techniques, recombinant DNA technology and bioremediation, bioremediation models, bioremediation software

Module II: Genetically modified organisms

Genetically modified food crops, food animals – examples and mode of production, future goals in GM food crops and animals, scientific evaluation of public concerns, legal requirements in production of GMO, current trends and consumer acceptance.

Module III: Molecular medicine

Gene mutation, point mutation, allele specific oligonucleotides, ARMS, oligonucleotide ligation, disease diagnosis with linked genetic markers, fluorescently labeled DNA sequencing.

Module IV: Nano-biotechnology

Introduction, definition, hybrid nanopracticles, smrat drug delivery, gene sensors, biomolecule control, nanofluids, nanotechnology in medicine.

Module V: Stem cells

Definition, properties, proliferation, culture of stem cells, medical applications of stem cells, ethical and legal issues in use of stem cells.

Module VI: Cancer Biology

Types of cancer, development, causes and properties of cancer, viruses (Hepatitis B & C, SV4U, polymo marines, pupillomarines, adenosines, retrovineses); retroviral oncogenes, proto-oncogenes, turmor suppressor genes, recent advances in detection and treatment of cancer.

Module VII: Forensic Biotechnology

MLP, SLP technology, PCR technology in crime detection, STR and databases, mitochondrial DNA and Y chromosome analysis in forensic science, DNA chip technology, role of molecular biology and biotechnology in crime detection.

Module VIII: Bio sensor

Biological reaction, amperometric biosensor, potentiometric biosensor, conductimetric bioseosors, calorimetric biosensor, piezoelectric biosensor, whole-cell biosensor, immunosensors.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- The Cell – A molecular Approach, 3rd Edn, Geoffrey M. Cooper and Robert E. Hausman, ASM Press
- Molecular Biology and Biotechnology, 4th Edn, J.M Walker and R. Rapley, Panima Books
- Cell Biology, David. E. Sadava, Panima Books
- Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press
- Environmental Microbiology, 2nd Edition, Ian L.Pepper and Charles P. Gerba, Elsevier Pub.
- Environmental Biotechnology – Concepts and Application, Hans – Joachim Jordening and Jesefwinter – Wiley – VCH

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BTB 708 **Credit Units: 03**

Course Objective:

Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents:

Module I: Introduction

Ecology and ecosystem.

Module II: Environmental pollution

Water, soil and air, noise and thermal pollution, their sources and effects.

Module III:Waste water (sewage and industrial effluents) treatments

Anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria- technical process and conditions, emerging biotechnological processes in waste - water treatment.

Module IV: Solid waste management

Landfills, composting, earthworm treatment, recycling and processing of organic residues**.**

Module V:Biodegradation

Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution

Module VI: Microbial leaching and mining

Microbial leaching and mining: Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Module VII:Wasteland

Wasteland: Uses and management, bioremediation and biorestoration of contaminated lands.

Module VIII:Environmental genetics

Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.

Module IX: Hazardous wastes

Hazardous wastes: source management and safety.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Biotechnology by PK Mohapatra

References:

- Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
- BiotreatmentSystems, Vol.22, D. L. Wise (Ed.), CRCPress, INC.
- Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association.

BIOPROCESS PLANT DESIGN

Course Code: BTB 709 **Credit Units: 03**

Course Objective:

The objective of this paper is to include not only the application of chemical engineering principles/unit operations to bioprocess systems but also to include the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I

Introduction; general design information; Mass and energy balance; Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Applied Process Design for Chemical and Petrochemical Plants, E.E. Ludwig, Butterworth-Heinemann
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann
- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling, F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design, E. Bausbacher and R. Hunt, Prentice Hall PTR.

ARTIFICIAL NEURAL NETWORKS

Course Code: BTB 710 **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, beides the closely related aspects of artificial neural networks.

Course Contents:

Module I

Historical background, Why is learning hard?

Module II

Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multi-layer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning,

Module III

The backpropagation algorithm, Aspects of Learning Theory and Generlization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?

Module IV

Neural networks and analog VLSI, Selected Applications

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Neural Networks: A Comprehensive Foundation, S. Haykin, Prentice Hall
- Neutral Networks for Pattern Recognition, C. Bishop, Oxford University Press

ADVANCED JAVA PROGRAMMING

Course Code: CSE 504 **CreditUnits: 03**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Course Contents:

Module I (5 Hours)

Introduction to Java RMI, RMI services, RMI client, Running client and server, Introduction of swing, swing components, Introduction to Multimedia Programming

Module II (5 Hours)

Database Connectivity using JDBC- Understanding JDBC, Define the layers in JDBC architecture, various types of JDBC drivers, manipulating various SQL Queries, Manage transactions and perform batch updates in JDBC, Creating Database Connectivity Applications, Connection to Database with the java.sql Package.

Module III (8 Hours)

Introduction to sever side programming, Introduction to Servlets, Web Container, Servlet Life Cycle, and Servlet based Applications, Servlet and HTML. Web.xml file. Session tracking

Module IV (6 Hours)

JSP: Introduction to JSP, JSP architecture, JSP syntax Basics, JSP implicit objects, JSP based Applications. The Model-View-Controller Architecture. Session management.

Module V (6 Hours)

Enterprise Java Beans:-EJB roles—EJB Client-Object -container-Transaction Management—implementing a Basic EJB Object-Implementing session Beans-Implementing Entity Beans-Deploying an enterprise Java Beans Object-Changes in EJB1.1 specification.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
- Professional Java Server Programming (a Press) By Allamaraju
- Developing Java Servlets (Techmedia – SAMS) By James Goodwill
- Using Java 1.2 Special Edition (PHI) By Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, "JAVA 2" PEARSON publication

Course Outcomes:

The student will learn

- Can develop Java Applets, Beans programming.
- Can Understand Advanced Java Networking concepts and develop server side application.
- Can learn Server Side Programming Concepts and create Dynamic web Application.
- Know about the JDBC Principles and can interact with back end database with java programming.
- Understand the application server and also understand the enterprise level applications.

BIOPROCESS TECHNOLOGY LAB

Course Code: BTB 720 **Credit Units: 01**

Course Contents:

Module I
Isolation of industrially important micro organisms for microbial processes.

Module II
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer

Module III
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module IV
Comparative studies of ethanol production using different substrates.

Module V
Production of single cell protein

Module VI
Production and estimation of alkaline protease

Module VII
Sauer Krant fermentation

Module VIII
Use of alginate for cell immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DOWNSTREAM PROCESSING LAB

Course Code: BTB 721 **Credit Units: 01**

Course Objective:

The laboratory will help the students to extract different bioproducts during their characterization since any of these products may be of biotechnological importance. They can be exploited in exploring the future biotechnology.

Course Contents:

Module I
Conventional filtration and membrane based filtration

Module II
Protein precipitation and recovery

Module III
Aqueous two-phase separation

Module IV
Ion exchange chromatography

Module V
Gel Permeation chromatography

Module VI
Electrophoresis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

ADVANCED JAVA PROGRAMMING LAB

Course Code: CSE 524 **CreditUnits: 1**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Programming Language: Java

1. Implement two services that should be run on a given network host. You should use JavaRMI. Develop a basic arithmetic calculator with the help of java RMI.
2. Write a Java program that can create an employee form for inserting the detail of employee in an organization by using Applets create a JFrame which have labels, text box, Radio button, Check Box, button etc.
3. For the above form write a programme to handle the events for checking the data input by user.
4. WAP that implement a JApplet and display the following frame
   a. Customer name
   b. Customer number
   c. Age
   d. Address
5. Write a Java program to access a table Employees for Oracle Sample database in HR Schema using Java code.
6. Write a Java program to manipulate a table Employees for Oracle Sample database in HR Schema using Java code.
7. Write a Java program that implement a simple servlet program.
8. Write a Java program for authentication,
   a). Create the Web Page for User-Name and Password
   b). Validate the login-id and password by the servlet code.
   c). Connecting a database using user-id and password.
9. Write a Java program to product selling web site
   a) Read data send by the client (HTML page)
   b) Insert data into the database using the prepared statement.
   c). Display the output to client for item purchased or not.
10. Write a Java program to include a HTML page into a JSP page to product purchasing.
   a) Read data send by the client (HTML page)
   b) Insert data into the database using the prepared statement.
   c). Display the output to client for item purchased or not.
11. Write a Java program using Enterprise Java Beans for creating an application
   a) Adding a Session EJB component to handle the business logic of the J2EE Application.
   b) Integrating the DAO into the Session EJB.
   c) Adding an Entity EJB
   d) Integrating the Entity EJB into the Session EJB.
   e) Interfacing the Web Tier with the Session EJB.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
- Professional Java Server Programming (a Press) By Allamaraju
- Developing Java Servlets (Techmedia – SAMS) By James Goodwill
- Using Java 1.2 Special Edition (PHI) By Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, “JAVA 2” PEARSON publication

Course Outcomes:

- Ability to design and develop Java Applets, Beans programming.
- Ability to design and structure the Server Side Programming Concepts.
- Ability to Create and design Dynamic web Application.
- Write the structured code for JDBC (back end database).
- Ability to develop and design the enterprise level applications.

COMMUNICATION SKILLS-VII

Course Code: BCU 741 **Credit Units: 1**

Course Objective:

The course is designed to empower students to carry out day to day communication at the work place by adequate understanding of various types of communication to facilitate efficient interpersonal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Meetings**	**30% Weightage**
	• Notices • Circulars • Agenda • Minutes	
2.	**odule II Report Writing & Telephony Skills**	**25% Weightage**
	➢ **Report Writing** • Purpose/Significance • Types • Format ➢ **Telephony Skills** • Call Receiving/ Handling/ Concluding Etiquette • Voice Modulation • Effective Listening • Dos and Don'ts of Telephony Skills	
3.	**Negotiation Skills** • Definition/Concept • Purpose/ Significance • Checklist- Good & Bad Practices	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• The Great Trial-Robert Payne • The Home Coming - Rabindra Nath Tagore • How Much Land does a Man Need? - Leo Tolstoy • Valiant Vicky, The Brave Weaver - Flora Anne Steel All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	

5. Student Learning Outcomes:

- Conduct all business activities related to the workplace with technical efficiency.
- Contribute positively to the overall growth of the organization.

6. Pedagogy for Course Delivery:

- Workshop
- Group Discussions
- Presentations
- Lectures

7. Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
T.N Chabbra , Business Communication , Sun India Publication.

Sanjay Kumar & Pushplata , Communication skills , Oxford University Press.

Reference: *Jones, Working in English, First Edition, Cambridge, CUP, 2001*.
AdditionalReading:NewspapersandJour

Behavioural Science - VII

Course Code: BSU-743 **Course Credit: 01**

Total Hours: 10

Course Objective

This course will help the students to:

- Explore interest and attitude
- Explore career opportunities
- Set career goals
- Developing attributes that employers value

Course Contents:

Module I: Career Planning **(2 Hours)**

- Importance of Career Planning & Development
- Career Development Plan
- Assessment of Career Development

Module II: Career Success: Interest, Aptitude & Attitude (Personality) **(2 Hours)**

- Interest, Aptitude & Attitude
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude

Module III: Explore Career for Growth **(2 Hours)**

- Selecting from available resources
- Career selection (Jobs)
- Career planning and development

Module IV: Self Reliance and Employability skills **(2 Hours)**

- Self awareness, Self promotion and Presentation, Self confidence
- Action planning, Networking, Negotiation
- Political awareness, Coping with uncertainty,
- Developing positive attributes at work place (personal and professional)
- Time Management as Self Management

Module V: Impression Management for Career Enhancement **(2 Hours)**

- Meaning & Components of Impression Management
- Impression Management Techniques(Influencing Tactics)
- Impact of Impression Management on Career Planning and Development

Student learning outcomes

- Students develop the ability to identify suitable career options and to create a suitable career plan based on the utilization of the counseling process, assessment tools, and other resources.
- Students will know how to assess their skills, interests and values.
- Students will know how to make informed career choices based on their self- assessment.
- Students will know how to explore relevant career options and build skills pertinent to those of greatest interest.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-VII

CourseCode:FLU744 **Creditunits:02**

CourseObjective:

Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable

- Todescribe anobject, compare objectsandevaluate
- Toaskforinformation, precision
- Tomake claims

CourseContents:

Dossier2–pg17-28,Dossier2:64millionsde consommateursActesdeCommunication:
Décrireunobjet(unbijouunique,unvoyageextraordinaire,unnouvelappareil photo)
Évaluerune chose (acheteruncadeau,discuterleprix)
Ouvriruncompteà la banque (demanderdesrenseignementsaubanquierafind'ouvriruncompte)
Demanderdes informations/précisions(précisionssurunproblème danslerelevéde compte)
Faire uneréclamation(s'adresserauservice après-vente pouréchangerunproduit défectueux)

Thèmesabordés:
S'habillerbonmarché (commentvoushabillez-vousbonmarché ?)
Le e-commerce (le portrait del'e-acheteurde votre pays)
Lesproduitscontrefaits(parlerdesproduitscontrefaits)
Laprofession:Lesmaraîchers(débats:commentéviterlegaspillage?lamodedeviedesdécroissants,privilégie-t- onla qualité oule prixlorsd'unachat?)

Grammaire :

1. Le pronom " en "
2. Laplace de l'adjectif
3. Le présent progressif
4. Le passé récent
5. Le futurproche(révision)
6. Le comparatifet le superlatif

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

SUMMER PROJECT - II

Course Code: BTB 760 **Credit Units: 06**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.

The students will be supervised by the internal faculty during the tenure of training.

The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report.

(Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing
It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material
Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding
First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report
After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font
For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50

Total:

GENOMIC AND PROTEOMICS

Course Code: BTB 801 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics.

Course Contents:

GENOMICS

Module I: Genome Evolution

Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).

Module II: Structural Genomics

Chromosome structure and Genome organization, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.

Module III: Comparative Genomics

Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.

Module IV: Functional Genomics

ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools

Module V: Genotyping Background and Applications.

Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.

PROTEOMICS

Module VI: Fundamentals of Proteomics

Proteomics Basics and 2D Gel Electrophoresis,
Protein Identification and Analysis:
a. Protein preparation and Separationb. Protein Identification by mass spectrometryc. Identification of post translation modification
Protein Expression Mapping,High-throughput cloning of ORFs,Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease.
Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- Biotechnology and Genomics by P.K.Gupta

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
- DNA : Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

DRUG DELIVERY SYSTEMS

Course Code: BTB 802 **Credit Units: 03**

Course Objective:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)

Module III: Drug administration

Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery.

Current technologies and new and emerging technologies in oral delivery

Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

MANAGEMENT ACCOUNTING AND COST CONTROL

Course Code: BCH 621 **Credit Units: 01**

Course Objective:

The course aims to develop an understanding of the importance, language and techniques of Financial, Cost and Management accounting, skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making. Student should be able to understand the basic concepts of Company accounts with reference to the Indian context.

Course Contents:

Module I

Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements

Module II

Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application

Module III

Variable and Absorption costing, Job-Costing and Process-Costing Systems,

Module IV

Tools for planning and control, Master budget, Flexible Budgets and Variance analysis

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cost Accounting, C.Horngreen, Prenctice Hall
- Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

- Management Accounting, C. Horngreen, Prenctice Hall

PROJECT MANAGEMENT

Course Code: BCH 622 **Credit Units: 01**

Course Objective:

The course aims atmaking an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process. Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Course Contents:

Module I: Introduction
Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure

Module II: Project Training
Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.

Module III: Project initiation
Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control

Module IV: Managing Risk
Risk Management Process: Risk Identification, Risk Assessment.
Risk Response Development: Risk Response Control

Module V: Project Termination
Project Auditing and Termination

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:

- Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.
The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I
Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II
Formal and informal organization, Performance appraisal, Training and development.

Module III
Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV
Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:
- The Practice of Management, P. Drucker, Harper Business.

ASP .NET

Course Code: CSE 804 **Credit Units: 03**
Total Hours: 30

Course Objective:
To create web based applications using ASP.NET and c#. Learns to create window based applications

Course Contents:

Module I: Introduction to .NET technologies (6 Hours)
Features of .NET, .NET Framework, CLR, MSIL, .NET class library, .NET Languages, CTS, assemblies, manifest, and metadata, What is ASP.NET?, Difference between ASP and ASP.NET.

Module II: Controls in ASP.NET (6 Hours)
Overview of Dynamic Web page, Understanding ASP.NET Controls, Applications, Web servers, Installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, validation Controls: Required Field Comparison Range. Calendarcontrol, Ad rotator Control, Internet Explorer Control.

Module III: Overview of ADO.NET and XML(8 Hours)
What is ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets , using Command & Data Reader, binding data to data bind Controls, displaying data in data grid, XML basics, attributes, fundamental XML classes: Document, text writer, text reader. XML validations, XML in ADO.NET, The XML Data Document.

Module IV: ASP.NET Applications(6 Hours)
Creating, tracking, caching, error handling, Securing ASP.NET applications- form based applications, window based application.

Module V: Web services(4 Hours)
Introduction, State management- View state, Session state, Application state, Building ASP.NET web services, working with ASP.NET applications, creating custom controls.

Course Outcomes:
The student will learn
- Develop dynamic web applications, create and consume web services
- Use appropriate data sources and data bindings in ASP.NET web applications
- Research and discover information about current topics, illustrate in an example, and present to the class.

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- ASP.NET Unleashed by Stephen Walther, SAMS publications

References:
- ASP.NET, Wrox Publications
- ASP.NET and VB.NET, Wrox Publication
- ASP.NET and C#.NET, Wrox publication.

GENOMICS AND PROTEOMICS LAB

Course Code: BTB 820 **Credit Units: 01**

Course Contents:

Module I

Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods

Module III

Gene finding tools and Genome annotation

Module IV

Comparison of two given genomes

Module V

Analysis of 2D – IEF data

Module VI

Microarray and Microarray data analysis

Module VII

Inference of protein function from structure

Module VIII

Inference of protein function and structure

Module IX

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ASP.NET LAB

Course Code: CSE 824 **Credit Units: 01**
Total Hours: 20

Course Objective:
This course is designed to provide the knowledge of Dot Net Frameworks along with C#

Software Required: Visual Studio and SQL server

Topics covered in lab will include the following Programs:

- Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
- Write a simple ASP.NET program to display the following Web Controls:

1. A button with text “clicks me”. The button control must be in the center of the form.
2. A label with a text hello.
3. A checkbox.

- The form name must be Web Controls
- Write a program to display “Welcome To Radiant” in the form when the “click” button is clicked. The form title must be ASP.NET.

IV. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.

- Write a program containing the following controls:

1. A ListBox
2. A Button
3. An Image
4. A Label

The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

VI. Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.

VII. Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.

VIII. Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.

IX. Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.

X. Check the length of the string in the TextBox using CustomValidator.

Course Outcomes:
After completion of the course the student will be able to use the features of Dot Net Framework along with the features of C#

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL – VIII

Course Code: BCU 841 **Credit Units: 1**

Course Objective:
This course is designed to hone the creative minds of students to develop knowledge of diverse ethnic groups and cultures and to increase self-awareness for cultural competence and sensitivity.
Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Speaking in Public** • Essentials in Public Speaking • Parameters of Public Speaking	**45% Weightage**
2.	**Module II Cross Cultural Communication** • Culture and Context • Awareness & Significance of Understanding Culture • Ethnocentrism, Stereotyping and Cultural Relativism • Cultural Shock and Social Change	**45% Weightage**
3.	**Module III Prose**	**10% Weightage**
4.	• India Cinema: Tradition & Change-Chidananda Das Gupta • Kabuliwala-Rabindranath Tagore • The Duchess and the Jewelller -Virginia Woolf • The Park- James Mathews All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
	Student Learning Outcomes: • Students will be able to navigate cross cultural encounters in a global economy. • Facilitate students to develop learning to construct and deliver messages that incorporate the appropriate use of organizing content, language, vocabulary, kinesics, eye contact, appearance, visual aids, and time constraints.	
5.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
6.	**Assessment/ Examination Scheme:** (see tables below)	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
Raman, Meenakshi. Business Communication, Oxford
Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011
References:
Beamer, Linda. Intercultural Communication in the Global Workplace, Irwin/McGraw-Hill, 2005.
Reynolds, Sana & Deborah Valentine. Guide to Cross-cultural Communication, Prentice Hall, 2003.
Additional Reading: Newspapers and Journals.

Behavioural Science – VIII

Course Code: BSU-843 **Course Credit:01**
Total Hours: 10

Course Objective:

- To have a great deal of insight into one's character.
- Understanding of positive emotions
- To explore the dimensions of happiness, well-being, Optimism and hope
- Quick understanding of different situations and grasp new concepts.

Course Contents:

Module I: Positivity in personality **(2 Hours)**

- Importance of Positivity in personality
- Positivity Vs. Negativity
- Introspection and personal growth

Module II: Positive Emotions **(2 Hours)**

- Understanding positive emotions
- Importance of Positive emotion
- Types and identification of positive emotions (Love, happiness, Contentment, Resilience, etc.)

Module III: Hope, Optimism and Resilience **(2 Hours)**

- Positive approach towards future
- Benefits of Positive approach
- Resilience during challenge and loss

Module IV: Application of Positive Emotions **(2 Hours)**

- Application of positive emotions in relationships, and organizations
- Creating healthy organizational climate
- Positive emotions enhances performance.
-

Module V: Happiness and Well Being **(2 Hours)**

- Concept of Happiness & Well-Being
- Secret of happy mind and healthy life
- Work life balance.

Student learning outcomes:

Students develop the ability to identify and regulate positive emotions for personal and professional excellence.

- Students will know how to develop resilience.
- Students will know how to role of happiness to attain wellbeing.
- Students will know how to nurture personality by positivity.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan D. (2005). Information and Knowledge Management Macmillan India Ltd. Delhi.

Français-VIII

CourseCode:FLU844 **Creditunits:02**

CourseObjective:
Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable
- Toexpressanintention, announce a news, enquireaboutanevent
- To speakaboutthe future
- Todiscussthemedia

CourseContents:
Dossier3–pg29-40,Dossiers1&2(révision). Dossier3:Médias.frActesdeCommunication:
Parlerdel'avenir(lesavantageset lesinconvénientsdesréseauxsociaux)
Exprimeruneintention(poserdesquestion
ssurunforum) Parlerdesmédias
Engager/ terminerune conversation(demanderpourquoionn'a pasréponduaumèl)
Interrogersurunévénement
(vol,accident)
Annoncerunenouvelle (celle
de démission)
Thèmesabordés:
LesFrançaiset la presse (débat: Croyez-vousauxlégendesurbaines?)
LesFrançaisetInternet(débat:lesinformationsdelapresseécritesontplusfiablesquelesinformationss urInternet ?)
LatélévisiondesFrançais
Laprofession: Lesanimateursradio(débat : pouroucontre le téléchargement illégal de la musique oudesfilms)
Grammaire :
1. Le futursimple
2. L'hypothèse surlefutur
3. Lesformesde la négation
4. Lespronomscomplémentsdirectset indirects (révision)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:
- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

MAJOR PROJECT

Course Code: BTB 860 **Credit Units: 16**

Course Objective:

The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	100
Viva Voce:	100
Total:	**200**

AMITYUNIVERSITY
MADHYA PRADESH

Bachelor of Science (Honours) Biotechnology

Programme Code: BSB

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2018 -2021

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAMME OBJECTIVE

B. Sc. (H) Biotechnology aims to develop highly specialized hard core specialization in various diversified areas of biotechnology and its application to medicine, agriculture, environment, nutraceuticals and functional food etc.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research orientated project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practical conducted in well equipped laboratories in the area of Biotechnology, Animal Biotechnology & Immunology. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biotechnology.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses:						
BSB 101	Cell Biology	3	-	-	3	
BSB 102	Maths& Biostatistics	3	-	-	3	
BSB 103	Plant Sciences– I	3	-	-	3	
BSB 104	Animal Sciences-I	3			3	
BSB 105	Chemistry – I	3	-	-	3	
BSB 120	Biotechnology Lab - I	-	-	2	1	
BSB 121	Chemistry Lab – I	-	-	2	1	
BSB 122	Plant Sciences Lab - I	-	-	2	1	
BSB 123	Animal Sciences Lab-I			2	1	
BSB 142	Environmental Studies – I	2	-	-	2	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BSB141	English Language Usage Essentials	30	-	-		
BSB 143	Understanding Self For Effectiveness	30	-	-		
 BSB 144 BSB 145 BSB 146 BSB 147 BSB 148	Foreign Language – I French German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses:						
BSB 201	Introductory Biochemistry & Biophysics	3	1	-	4	
BSB 202	Bioanalytical Techniques	3	-	-	3	
BSB 203	Plant Sciences – II	3	-	-	3	
BSB 204	Animal Sciences-II	2	1		3	
BSB 205	Chemistry – II	3	-	-	3	
BSB 220	Biotechnology Lab – II	-	-	2	1	
BSB 221	Chemistry Lab – II	-	-	2	1	
BSB 222	Plant Sciences Lab – II	-	-	2	1	
BSB 223	Animal Sciences Lab-II	-	-	2	1	
BSB 242	Environmental Studies – II	2	-	-	2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any ThreeHrs/Semester						
BSB 241	Introduction to Communication Skill	30	-	-		
BSB 243	Individual, Society and Nation	30	-	-		
 BSB 244 BSB 245 BSB 246 BSB 247 BSB 248	Foreign Language – II French German Spanish Japanese Chinese	30	-	-		

V. dastar

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses:						
BSB 301	Genetics	3	-	-	3	
BSB 302	Microbiology	3	-	-	3	
BSB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BSB 304	Anatomy & Plant Physiology	3	-	-	3	
BSB 305	Animal Physiology-I	2	1	-	3	
BSB 306	Chemistry – III	3	-	-	3	
BSB 320	Biotechnology Lab – III	-	-	4	2	
BSB 321	Chemistry Lab – III	-	-	2	1	
BSB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BSB 323	Animal Physiology Lab-I	-		2	1	
BSB 330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**25**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 341	Communication Skill - III	30	-	-		
BSU343	Behavioural Science - III	30	-	-		
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
BSB 401	Bioinformatics	3	-	-	3	
BSB 402	Molecular Cell Biology	3	-	-	3	
BSB 403	Immunology	3	-	-	3	
BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BSB 405	Animal Physiology-II	3	-	-	3	
BSB 406	Chemistry – IV	3	-	-	3	
BSB 420	Biotechnology Lab - IV	-	-	4	2	
BSB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BSB 422	Animal Physiology Lab-II	-	-	2	1	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 441	Communication Skill - IV	30	-	-		
BSU443	Behavioural Science - IV	30	-	-		
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

V. dastar

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses:						
BSB 501	Plant Biotechnology	3	-	-	3	
BSB 502	Animal Biotechnology	3	-	-	3	
BSB 503	Immunotechnology	2	1	-	3	
BSB 504	Genomics& Proteomics	3	-	-	3	
BSB 505	Recombinant DNA Technology	3	-	-	3	
BSB 506	Microbial Technology	3	-	-	3	
BSB 520	Biotechnology Lab - V	-	-	4	2	
BSB 521	Genomics & Proteomics Lab	-	-	4	2	
BSB 550	Summer Training (Evaluation)	-	-	-	5	
	TOTAL				**27**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 541	Communication Skill - V	30	-	-	1	
BSU 543	Behavioural Science - V	30	-	-	1	
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-	2	

SIXTH SEMESTER

Compulsory Courses:						
BSB 601	Environmental Biotechnology	4	-	-	4	
BSB 602	Industrial Biology	4	-	-	4	
BCH 623	Principles of Management &Entrepreneurship Development	1	-	-	1	
BSB 620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BSB 660	Project (10-12 Week)	-	-	-	12	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 641	Communication Skill - VI	30	-	-		
BSU643	Behavioural Science - VI	30	-	-		
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

CELL BIOLOGY

Course Code: BSB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology - Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker , Klinshmith& Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: BSB 102 **Credit Units: 03**

Course Objective:

The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course

Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II

Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III

Measure of central tendency and measure of dispersion

Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution

Simple problems involving Binomial, Poisson and Normal variables,

Module IV

Correlation and regression,

Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:

- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: **BSB 103** **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Algae
Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi
Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:, *Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes
Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: **BSB 104** **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.
-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:
-Protozoa: Type study of *Plasmodium.*
-Porifera: Type of *Sycon.*

Module III
-Coelnterata: Type study of *Ovelia.*
-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates
-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*
-Arthropoda: Type Study of *Prawn*

Module V:
Mollusca: Type Study of *Pila*
Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: **BSB 105** **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd**.**
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: BSB 120 **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: BSB 121 **Credit Units: 01**

Course Contents:
INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Plant Sciences - I

Course Code: **BSB 122** **Credit Units: 01**

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Sciences - I

Course Code: **BSB 123** **Credit Units: 01**

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: **BSB 141** **CreditUnits: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

ENVIRONMENTAL STUDIES – I

Course Code: **BSB 142** **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem

Structure and function of an ecosystem

Producers, consumers and decomposers

Energy flow in the ecosystem

Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

Biodiversity at global, national and local levels

India as a mega-diversity nation

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts

Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: BSB 143 **Credit Units: 01**

Course Objective:
This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effect on personality
Building emotional competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning & Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and Nature of Attitude
Components and Types of Attitudes
Relevance and Importance of Attitudes

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, Components, Importance and Relevance
Positive and Negative Emotions
Healthy and Unhealthy expression of Emotions

Module VI:End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company

FRENCH - I

Course Code: **BSB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A:pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical :Unité 1: Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3 :Organiser son temps

1. dire la date et l'heure

Contenu grammatical :

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
   Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futurproche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BSB 201 **Credit Units: 04**

Course Objective:

Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Course Contents:

Module I: Nature of Biological materials

carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules

Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic

Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body

Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments

Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:

- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry - Voet&Voit

BIOANALYTICAL TECHNIQUES

Course Code: **BSB 202** **Credit Units: 03**

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Course Contents:

Module I: Instruments, basic principles and usage

pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques

Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis

Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

Plant Sciences - II

Course Code: BSB 203 Credit Units: 03

Course Objective:
The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Course Contents:

GYMNOSPERMS

Module I
General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II
Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III
Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV
Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:
- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

Animal Sciences - II

Course Code: BSB 204 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:
- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)
- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)
- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: **BSB 205** **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I
Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II
Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III
Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV
Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V
Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:
- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – II (BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: BSB 220 **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BSB 221 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH^{1+}, K^{1+}, CO^{2-}, S^{2-}, SO^{2-}, NO^{1-}, $CH\ COO^{1-}$, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO^{1-}, SO^{2-}, $C\ O^{2-}$, PO^{3-}, BO^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: **BSB 222** **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: **BSB 223** **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear

Different types of important edible fishes of India

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Development of chick up to formation of primitive streak

Module V: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: **BSB 241** **CreditUnits: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication
Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation
Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills
Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills
Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays
Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya
Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, MalraTreece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

ENVIRONMENTAL STUDIES – II

Course Code: **BSB 242** **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV: Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

INDIVIDUAL, SOCIETY AND NATION

Course Code: **BSB 243** **Credit Units: 01**

Course Objective:
To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Thinking skills
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking

Module II: Hindrances to Problem Solving
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving Process
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
Convergent and Divergent thinking
Idea generation and evaluation (Brain Storming)
Image generation and evaluation
Debating
The six-phase model of Creative Thinking: ICEDIP model

Module VI:End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: BSB 244 **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.

To make them learn the basic rules of French Grammar.

Course Contents:

Module A : pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
3. Faire un programmed'activités

imaginer une conversation téléphonique/un dialogue

Propositions- interroger, répondre

Unité 4:Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifsdémonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   A. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

GENETICS

Course Code: BSB 301 Credit Units: 03

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Course Contents:

Module I

Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II

Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV

Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V

Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI

Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII

Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: BSB 302 **Credit Units: 03**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery, origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I: History and development of microbiology

Introduction, contribution of Scientists (Leeuwenhoek, Pasteur, Koch etc.), role of microorganisms in transformation of organic matter and in the causation of diseases. Pasteur's experiments, concept of sterilization, microscopy (optical, TEM and SEM), concept of microbial species and strains; general outline of various forms of micro-organisms.

Module II: Ultra Structure of Prokaryotic cell

Nature of the microbial cell surface, Prokaryotic structure and function - cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions, gram positive and gram negative bacteria and endospores.

Module III

Nutritional classification of microorganisms, isolation of auxotrophs (replica plating), analysis of mutations in biochemical pathways, microbial assays for vitamins and antibiotics, strain improvement by selection.

Module IV: Control of microorganisms

Methods of sterilization & disinfection (Physical agents &chemical agents)Antibiotics with special reference to antibacterial & antifungal antibiotics, mode of actions,drug resistance .

Module V: Microbial agents of diseases

Clinically important Bacterial & fungal diseases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **BSB 303** **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

ANATOMY & PLANT PHYSIOLOGY

Course Code: **BSB 304** **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Course Contents:

Module I
Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviour of cambium in *Achyranthes*, *Boerhaavia*, *Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II
Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III
Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV
Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: **BSB 305** **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSB 306 **Credit Units: 03**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I
Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II
General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III
Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV
Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V
Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI
Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III
(BASED ON GENETICS, MICROBIOLOGY, AND BIOCHEMISTRY AND METABOLIC REGULATION)

Course Code: BSB 320 **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation

Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human

Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.

Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.

Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BSB 321 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO $^{2+}$ as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BSB 322 **Credit Units: 01**

Course Contents:

Module I: Physiology
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.
Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.
Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)
Experimentation- Separations of photosynthetic pigments by thin layer chromatography.
Respiration – Determination of R.Q.
Module II: Plant Anatomy
Anatomy of normal dicot and monocot roots, stems & leaves
Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSB 323 **Credit Units: 01**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing** • Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	**35%Weightage**
2.	**Module II** **Formal Letter Writing** • Block Format • Types of Letters • E-mail • Netiquette	**35% Weightage**
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories** • Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	**10%Weightage**
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*
K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar &Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

BehaviouralScience–III

CourseCode:BSU-343 CourseCredit:01

Course Objective:

To enable the students:
• Understand the process of problem solving and creative thinking.
• Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)
• What is thinking: The Mind/Brain/Behavior
• Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
• Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
• Perception
• Expression
• Emotion
• Intellect
• Work environment

Module III: Problem Solving (2 Hours)
• Recognizing and Defining a problem
• Analyzing the problem (potential causes)
• Developing possible alternatives
• Evaluating Solutions
• Resolution of problem
• Implementation
• Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
• Construction of POA
• Monitoring
• Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
• Definition and meaning of creativity
• The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
• The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes

▪ Student will be able to understand and solve the problems effectively in their personal and professional life.
▪ Students will outline multiple divergent solutions to a problem,
▪ Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

ExaminationScheme:

EvaluationComponents	Attendance	JournalofSuccess(JOS)	SocialAwarenessProgram(SAP)SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

SuggestedReadings:

•Michael Steven:Howto bea betterproblem solver,Kogan Page, NewDelhi, 1999
•GeoffPetty:Howto be betteratcreativity; Kogan Page, NewDelhi, 1999
•RichardY. Chang and P. Keith, Kelly:Wheeler Publishing,NewDelhi, 1998. •Phil Lowe KogePage:Creativityand Problem Solving, NewDelhi, 1996
•JWilliamPfeiffer(ed.)TheoriesandModelsinAppliedBehaviouralScience,Vol3,Management(1996); Pfeiffer&Company
•Bensley,AlanD.:CriticalThinkinginPsychology–AUnifiedSkillsApproach,(1998),Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Creditunits:02**

Course Objective:

Toenablethestudents

- totalkaboutthequalitiesanddefectsofpeople.
- toask/give directions,toenquireaboutalodging.
- toaskandgiveinformationsaboutacertainplace.
- todescribeeventsinpasttense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parlerdesqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,sesituerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage,
sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerlasatisfactionetl'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassécomposé,formeet accordduparticipepassé,lanégationaupassécomposé
5. lesindicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineetal.A proposA1Livre del'élève.Grenoble:PressesuniversitairesdeGrenoble,2010.

· Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:PressesuniversitairesdeGrenoble,2010.

Références:

· Girardeau,BrunoetNellyMous.RéussirleDELFA

TERM PAPER

Course Code: BSB 330 Credit Units: 02

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject. The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is.

You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts,) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%
(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOINFORMATICS

Course Code: BSB 401 **Credit Units: 03**

Course Objective:
The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Course Contents:

Module I: Computers
General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics
Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases
Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis
Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.
Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification.

Module V: Genome analysis
Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:
- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: **BSB 402** **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic informations are stored, expressed and transmitted among generations.

Course Contents:

Module I: Introduction to Moleculer Biology,

Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.

Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.

Module II:Insertion elements, transposons and retrotransposons

Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.

Application of genetic engineering

Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes

Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.

Module III: Structure of prokaryotic and eukaryotic genes

Transcription mechanism in prokaryotes and eukaryotes.

Translation : Translation mechanisms in prokaryotes and eukaryotes.

Module IV: Gene Expression in prokaryotes

Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)

Module V:Eukaryotic geneExpression

Overview of gene expression, polyadenylation, cap formation, RNA degradation.

Module VI: Oncogenes and Tumor Suppressor genes

Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY

Course Code: BSB 403 **Credit Units: 03**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I
Historical perspective of immune system and immunity; Innate and specific immunity.

Module II
Humoral immunity and Clonal selection theory;

Module III
Cell-mediated immunity.

Module IV
The organs and cells of the immune system.

Module V
Histocompatibility: structure of MHC class I, II & III antigens & their mode of antigen presentation, MHC restriction; Antigens & antigenicity;

Module VI
Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:
- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Course Contents:

Module I
Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.
Module II
Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding
Module III
General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.
Module IV
Economic importance with special reference to plants yielding:
a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
b) Common fibre yielding plants - Cotton, Jute .
c) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
d) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:
- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BSB 405 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals
- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:
- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:
- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization
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Module IV:Developmental Biology:
- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: **BSB 406** **Credit Units: 03**

Course Objective:
The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic & non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates
Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II
General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III
General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV
Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics
Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry
Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry
Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:
- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY – IV LAB
(BASED ON BIOINFORMATICS, MOLECULAR CELL BIOLOGY, IMMUNOLOGY)

Course Code: BSB 420 **Credit Units: 02**

Course Contents:

Module I: Computers
Handling of computers and Data analysis using Oracle (create, append, delete, pack, display, list count, set, order, index, sort)

Module II: Bioinformatics
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.

Module III
Isolation of nuclear DNA (genomic & plasmid DNA)

Module IV
Blood film preparation &identification of blood cells
Study of blood groups
Study of ELISA.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSB 421 **Credit Units: 01**

Course Contents:

Module I: Embryology
Study of permanent slides of the**:**
a) T.S. anther, pollen, germinating pollen
b) L.S. ovule types
c) Endosperm
d) Embryos
e) L.S. caryopsis
f) Dissection of embryo

Module II:Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code:BSB 422 **Credit Units: 01**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland

- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.

- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  -Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- IsmatChughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text:*Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred& Walter E. Oliu. The Business Writer's Companion, Bedford:***

St. Martin's Press, 2010.Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

BehaviouralScience-IV

CourseCode:BSU-443 **CourseCredit:01**
TotalHours:10

CourseObjective:
This course aims at imparting an understanding of Values, Ethics& Moralityamongstudents formakinga balanced choice between personal& professional development.

CourseContents:

ModuleI:IntroductiontoValues&Ethics **(2Hours)**
Meaning & itstype
Relationship between Valuesand
Ethics Its implication inone's life

ModuleII:ValuesClarification&Acceptance **(2Hours)**
CoreValues-Respect, Responsibility, Integrity, Resilience,Care,&
Harmony Its process-SelfExploration
Nurturing Goodvalues

ModuleIII:Morality **(2Hours)**
Difference
betweenmorality,ethics&values
Significance ofmoralvalues

ModuleIV:EthicalPractice **(2Hours)**
Ethical Decisionmaking
Challenges in its
implementation
Prevention
ofCorruption&Crime

ModuleV:Personal&ProfessionalValues **(2Hours)**
Personal values-Empathy,honesty, courage,
commitment Professional Values-Work ethics,
respect for others
Its role in personalitydevelopment Character building- New-self awarness

Studentlearningoutcomes

- Able to answerthe question: WhatdoIstand for?
- Abilitytoapplya coherentsetof moralprinciples within professional andspecialized contexts
- Willingto make unpopularbut right decision
- Committed toworkingfor justiceand peacelocallyand globally.

ExaminationScheme:

EvaluationComponents	Attendance	JournalofSuccess (JOS)	SocialAwarenessProgram(SAP) SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

Text&References:

Cassuto Rothman, J. (1998). Fromthe FrontLines, Student Casesin Social Work Ethics.NeedhamHeights, MA: Allyn and Bacon.
Gambrill, E. &Pruger,R. (Eds). (1996).Controversial Issues in Social Work Ethics, Values, & Obligations. NeedhamHeights, MA:Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:
Tostrengthenthelanguage ofthestudent’sinbothoralandwritten
Torevisethe grammarinapplicationandthecommunicationtasksrelatedtotopicscoveredalready
Togetacquaintedwiththecurrent
socialcommunicationskills,oral(dialogue,telephoneconversations,etc.)and
writtenandperformsimplecommunicationtaskssuchas

- talkingaboutpersonalhabits
- narratingeventsinthepast,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:
Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot
ActesdeCommunication:
Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’exprimer
autéléphone,demanderetdonnerunavis.
Dossiers1,2,3–Révision
Exercicesd’écoute,productionoraleet écrite.
Grammaire :
1. l’imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:
Text:
Le livre àsuivre:
Andant,Christineetal.A proposA1Livre del’élève.Grenoble:PressesuniversitairesdeGrenoble, 2010.
Andant,Christineetal.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.
Référence:Girardeau,BrunoetNellyMous.RéussirleDELFA1.Paris: Didi

PLANT BIOTECHNOLOGY

Course Code: BSB 501 **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micropropagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: **BSB 502** **Credit Units: 03**

Course Objective:
The aim of the course is to provide equal importance to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I
Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines.

Module II
Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module III
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF,erythropoietin).

Module IV
Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication.

IMMUNOTECHNOLOGY

Course Code: **BSB 503** **Credit Units: 02**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to mankind.

Course Contents:

Module I
Immunoglobulin gene: genetic basis of reation of antibody diversity; Effect of T cell functions.

Module II
Measurement of antigen – antibody interaction: agglutination, immunodiffusion, immuno-electrophoresis, ELISA, RIE, production of monoclonal antibodies.

Module III
Antibodies in targeting therapeutic agents.

Module IV: Hybridoma Technology
Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application

Module V
Tissue and organ transplant

Module VI
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination.
Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman.

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company.
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins.
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

GENOMICS& PROTEOMICS

Course Code: BSB 504 **Credit Units: 02**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Course Contents:

GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome : 2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.
Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BSB 505 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Course Contents:

Module I
Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II
Methods of DNA Introduction into living cells.

Module III
Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV
Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V
Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.
PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Gene cloning and DNA analysis by T.A. Brown

References:
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

MICROBIAL TECHNOLOGY

Course Code: **BSB 506** **Credit Units: 03**

Course Objective:

The basic knowledge of Microbiology gained in the previous semester would the applied in the various disciplines like evolution, Immunology & Industrial fermentation**.**

Course Contents:

Module I

Microbial nutrition and growth -The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module II

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module III

Host-parasite relationship (Normal micro flora of skin, oral cavity, gastrointestinal tract), types of toxins (Exo, endo, entero) and their structure and mode of actions, Microbe Interactions with other populations.

Module IV

Microbes in extreme environments: Archae as the earliest forms, thermophiles, pyshrophiles, halophiles, alkalophiles, acidophiles , hyperthermophiles.

Module V

Introduction to industrially important microbes and microbial fermentative products (Production of antibiotics with special refernce to penciliin& streptomycin, enzymes, biotransformation of steroids), food products from microbes (Dairy &SCP etc)

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOTECHNOLOGY LAB – V(BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BSB 520 **Credit Units: 02**

Course Contents:

Module I
Sterilization techniques of glass wares &equipments.
Preparation of cotton plugs & culture media .
Preparation and sterilization .of different explants.
Inoculation of explants on culture media.

Module II
Culture of plant embryos/seeds.Callus culture, Testing of seed viability.

Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

Module IV
Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD &*E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BSB 521 **Credit Units: 02**

Course Contents:

Module I
Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II
Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III
Comparison of two given genomes- Mummer.

Module IV
Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	• Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	
2.	**Module II Comprehension Skills**	**25% Weightage**
	• Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text:Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

CourseCode:BSU-543 **CourseCredit:01**
TotalHours:10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

EvaluationComponents	Attendance	JournalofSuccess(JOS)	SocialAwarenessProgram(SAP)SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann&Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**
CourseObjective:
Tostrengthenthelanguage ofthestudent'sinbothoralandwritten
Torevisethe grammarinapplicationandthecommunicationtasksrelatedtotopicscoveredalready
Togetacquaintedwiththecurrent socialcommunicationskills, oral (dialogue, telephoneconversations,etc.)Andwrittenandperformsimplecommunicationtaskssuchas

- narratingeventsinthepast,markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriatelogical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivreensemble
ActesdeCommunication:
Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,
l'écologie,identifieretdécrirelesdifférencesdecomportement,décrirele fonctionnementd'uneassociation,fairelabiographied'une personne.
Dossiers4, 5,6–Révision
Exercicesd'écoute,productionoraleet écrite.
Grammaire :
1. le présent (révision),lepassécomposé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:
Le livre àsuivre:
· Andant,Christineetal.A proposA1Livre del'élève.Grenoble:PressesuniversitairesdeGrenoble,2010.
· Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.
Références:
· Girardeau,BrunoetNellyMous.RéussirleDELFA1.Paris: Didier,2010.

SUMMER TRAINING

Course Code: BSB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of Summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

- This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BSB 601 **Credit Units: 04**

Course Objective:
The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Course Contents:

Module I
Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II
Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III
Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV
Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V
Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code:BSB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Course Contents:

Module I
Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II
Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III
Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, SCP.

Module IV
Production of fermented dairy products

Module V
Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Industrial Microbiology – Cassida

References:
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot &Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **CreditUnits: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code:BSB 620 **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials** • Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	**30% Weightage**
2.	**Module II Workplace Interpersonal Skills** • Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	**25% Weightage**
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose** • Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	**10% Weightage**
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire uneréservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BSB 660 **CreditUnits: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables   and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

➢ **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

➢ **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➢ **Review of Literature and Definition of Problem**

➢ **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ **Summary**

➢ **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

Master of Science (Biotechnology)

Programme Code: MSB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2018 - 20

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.
This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.
The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAM OBJECTIVE

The objective of Masters Programme in Biotechnology of Amity University is to develop multifaceted academically excellent students in various areas of Biotechnology. The course also aims to enhance the knowledge gained by them in the undergraduate curriculum so as to make them competent for future, academic or industrial pursuits.

The subjects included in the course curriculum suffice for both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practicals conducted in well-equipped laboratories. Subjects like Cell Biology, Genetics, Enzymology, Microbiology, Plant Biotechnology, Animal Biotechnology, and Immunology have contents with molecular approach so as to fulfill the requirements of current research and developmental needs. Industry oriented subjects like bioprocess engineering, downstream processing is taught for imparting knowledge of biotechnological application in industry.
In addition, molecular biology and recombinant DNA Technology is taught at advanced levels as they form the core foundation of biotechnology and biotechnological processes.

Therefore the present postgraduate curriculum in Biotechnology is aimed to produce highly motivated challenging young biotechnologist to take our country on the path of Biotechnology revolution.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MSB101	Advanced Biochemistry	3	-	-	3	
MSB102	Advanced Microbial Technology	3	-	-	3	
MSB103	Biophysics & Bioanalytical Techniques	3	-	-	3	
MSB104	Advanced Cell Biology & Genetics	3	1	-	4	
MSB105	Advanced Biostatistics for Biologists	3	-	-	3	
MSB106	Computer Applications	3	-	-	3	
MSB120	Biochemistry Lab	-	-	4	2	
MSB121	Advanced Microbial Technology Lab	-	-	2	1	
MSB122	Cell Biology & Genetics Lab	-	-	2	1	
MSB123	Computer Applications Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB141	Advanced Communication	30	-	-		
MSB143	Self-Development for Interpersonal	30	-	-		
	Foreign Language - I	30	-	-		
MSB144	French					
MSB145	German					
MSB146	Spanish					
MSB147	Japanese					
MSB148	Chinese					

SECOND SEMESTER

Compulsory Courses:						
MSB201	Advanced Molecular Biology	4	-	-	4	
MSB202	Advances in Genetic Engineering	4	-	-	4	
MSB203	Bioprocess Technology	4	-	-	4	
MSB204	Advanced Genomics & Proteomics	4	-	-	4	
MSB205	Computational Biology	3	-	-	3	
MSB206	Environmental Biotechnology	3	-	-	3	
MSB220	Advanced Molecular Biology Lab	-	-	4	2	
MSB221	Genetic Engineering Lab	-	-	4	2	
MSB222	Bioprocess Technology Lab	-	-	4	2	
MSB223	Advanced Genomics & Proteomics Lab			2	1	
MSB224	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB241	Communicational for Employment	30	-	-		
MSB243	Conflict Resoultion and Management	30	-	-		
	Foreign Language - II	30	-	-		
MSB244	French					
MSB245	German					
MSB246	Spanish					
MSB247	Japanese					
MSB248	Chinese					

SUMMER INTERNSHIP OF 09 -12 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MSB301	Advanced Immunology	3	-	-	3	
MSB302	Enzyme Technology	3	-	-	3	
MSB303	Drug Design & Development	3	-	-	3	
MSB304	Advanced Animal Biotechnology	3	-	-	3	
MSB305	Advanced Plant Biotechnology	3	-	-	3	
 MSB306 MSB307 MSB308 MSB309 MSB310 MSB311	**Elective (Select any One)** • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
MSB320	Advanced Immunology Lab	-	-	2	1	
MSB321	Enzyme Technology Lab	-	-	2	1	
MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
MSB350	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP341	Advanced Communication - III	30	-	-		
BSP343	Behavioral Science - III	30	-	-		
 FLP344 FLP345 FLP346 FLP347 FLP348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
MSB460	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

ADVANCED BIOCHEMISTRY

Course Code: MSB 101 **Credit Units: 03**

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Course Contents:

Module I

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module II: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module III: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module IV: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module V: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VI: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), Lubert Stryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: MSB 102 Credit Units: 03

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Course Contents:

Module I: Introduction to microbiology

Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms

Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics

Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation. Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology

Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: MSB 103 **Credit Units: 03**

Course Objective:
Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Course Contents:

Module I: Membrane Biophysics
Genesis of membrane potential in nerve & membrane, Nerst & Goldman equation, Patch Clamp and Voltage – Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**
- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: **MSB 104** **Credit Units: 04**

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and subcellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.

Extrachromosomal inheritance:, Mitocondrial and chloroplast genetic code

Chromosomal aberration and polyploidy

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage.

Population genetics- Hardy weinbergs selection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase, Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer**,** cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MSB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: MSB 106 Credit Units: 03

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers

Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office

Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.

Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system

Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce

Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language

Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF .. ELSE statements – Looping concepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj & Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: MSB 120 **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test.
Quantitation of protein by Bradford method
Separation of proteins by SDS-PAGE

Module II: Enzyme
Enzyme activity study of serum alkaline phosphatase

Module III: Nucleic Acid
Biochemical estimation of DNA
Biochemical estimation of RNA
Separation of DNA on Agrose gel.

Module IV: Carbohydrate
Biochemical estimation of blood sugar

Module V: Lipids
Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ADVANCED MICROBIAL TECHNOLOGY LAB

Course Code: MSB 121 **Credit Units: 01**

Course Contents:

Module I
Aseptic techniques: preparation of culture media for cultivation of specific microorganism.
Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II
Biochemical test - Indole test. methyl red test. voges proskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III
Isolation of special microbes from environment by isolation and enrichment techniques
Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD
Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV
Antibiotic sensitivity test by disc diffusion assay

Module V
Biochemical and molecular characterization of micro organisms
Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: **MSB 122** **Credit Units: 01**

Course Contents:

Module I
Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II
Isolation of chloroplast from spinach and study of electron transport chain.

Module III
Isolation of mitochondria and study of electron transport chain.

Module IV
Study of apoptosis by TUNEL method.
Site directed mutagenesis
Mutation detection and analysis
Mitosis
Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: **MSB 123** **Credit Units: 01**

Course Contents:

Module I: Ms-Office
Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003
Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language
Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

ADVANCED COMMUNICATION

Course Code: **MSB 141** **Credit Units: 01**

Course Objective:

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: **MSB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: MSB 144 Credit Units: 02

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1, 2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

1. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
   Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED MOLECULAR BIOLOGY

Course Code: **MSB 201** **Credit Units: 04**

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Course Contents:

Module I: DNA replication and repair
DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA
Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA
Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation
Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.

Module V: Regulation of gene expression
Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing
RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme
Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: **MSB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes. Baculllo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: **MSB 203** **Credit Units: 04**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: **MSB 204** **Credit Units: 04**

Course Objective:
The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

PART I: GENOMICS

Module I
Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II
Transcriptomics and metatranscriptomics: Introduction , method and uses. genetic mapping

Module III
Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV
Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V
Introduction to proteomics
Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI
Post translational protein modification

Module VII
Protein – protein interaction some examples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

References:
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: MSB 205 Credit Units: 03

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

1. Major information Resources & Databases in Bioinformatics
    a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
    b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
    c. Derived (Secondry) Databases of Sequences and structure:
        i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
        ii. SCOP, CATH, DSSP, FSSP, RNAbase,
    d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
2. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
3. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
4. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
5. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
6. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
7. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)

Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.

Suffix tree and its applications in Bioinformatics

Gene Indentification Methods

Predictive Methods using DNA and Protein sequences.

Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.

Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.

Phylogenetics analysis software.

Molecular Structure drawing tool.

Molecular modeling/Docking.

Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

***References*:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MSB 206** **Credit Units: 03**

Course Objective:

The objective of this course is to familiarize the students with the processes and micro organism that can be employed for a cleaner environment. The students will be applying basic knowledge of microbiology for developing the practices for a cleaner environment, water, fuel, fertilizer, pesticides etc. The course also aims to make the students aware of legislation and acts prevalent to control the degradation of our eco system.

Course Contents:

Module I

Treatment of municipal wastes and industrial effluents (Physico-Chemical, biological analysis of waste water), Rr. Sec and test waste water treatment sludge treatment and disposal treatment of wastes from paper, textile, dairy, petrochemical and pharmaceutical industry .

Module II

Bioremediation and phytoremediation of toxic compounds like pesticides, hydrocarbons, polymers, surfactants, biotransformation and bioaccumulation

Module III

Renewable and non-renewable energy resources, clean fuel technology, biofuels.

Module IV

Biofertilizers and biopesticides – a cleaner agricultural practice, concept of N_2 - fixation, azolla, cyanobacteria, Rhizobium and VAM as biofertilizers.

Module V

Biomining – microbe assisted microbial leaching, bioaccumulation and bio sorption
Biosensors and biomarkers for ecotoxicity measurement, EIA and Environmental audit.

Module VI

Principles in ecotoxicology; animal toxicity tests; statistical concepts of LD_{50}; dose-effect and dose response relationship; frequency response and cumulative response; Biological and chemical factors and influence toxicity; global dispersion of toxic substance; dispersion and circulating mechanisms of pollutants; Aquatic toxicity testes; statistical tests; response of planktons to toxicants; EC_{50};

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Introduction to Environmental Biotechnology, Milton Wainwright

***References*:**

- Waste Water Engineering, Metcalf and Eddy. Publisher: Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, Jonh F.T. Spencer
- Principles of Environmental Engineering, Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: **MSB 220** **Credit Units: 02**

Course Contents:

1. Isolation of genomic DNA from prokaryotic and Eukaryotes.
2. Isolation of plasmid.
3. Study of DNA protein interaction.
4. Study of in vitro transcription.
5. Study of DNA methylation.
6. Study of DNA repair mechanism.
7. Invitro study of translation
8. Isolation of RNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: **MSB 221** **Credit Units: 02**

Course Contents:

1. Study of gene expression in E.coli.(GFP cloning).
2. Study of Southern Hybridization.
3. Study of RFLP/RAPD.
4. Study of Western blotting.
5. Study of restriction digestion.
6. Study of legation.
7. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: **MSB 222** **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: **MSB 223** **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II

PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF data using PDquest software

Module IV

Primer designing, Analysis of protein 3D structures and comparison,. Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: **MSB 224** **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MSB 241** **Credit Units: 01**

Course Objective:
To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: **MSB 243** **Credit Units: 01**

Course Objective:
This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MSB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
3. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED IMMUNOLOGY

Course Code: MSB 301 **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.

Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: MSB 302 Credit Units: 03

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes
Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

References:
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

DRUG DESIGN AND DEVELOPMENT

Course Code: MSB 303 Credit Units: 03

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification
DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II
Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III
Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV
Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR
Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

***References*:**

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: **MSB 304** **Credit Units: 03**

Course Objective:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Course Contents:

Module I
Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II
Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III
DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV
Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V
Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: **MSB 305** **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques

Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II

Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III

Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV

Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V

Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DELIVERY SYSTEMS

Course Code: **MSB 306** **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MSB 307** **Credit Units: 03**

Course Objective:
The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs**.**

Module IV
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:
- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14 Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MSB 308** **Credit Units: 03**

Course Objective:

The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:

- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: **MSB 309** **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases. Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: **MSB 310** **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code : MSB 311 **Credit: 03**

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

1. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
2. Organizational Structure and management
3. Capital Management
4. Product innovation and management
5. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

1. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
2. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
3. Basics of material management

Module III

1. Kaizen { Continuous improvement in product and management }
2. Six Sigma
3. Biotech enterprises: Small, Medium and Large.
4. Quality control in Biotech industries.

Module IV

1. Government Regulations for Biotech product.
2. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
3. Business development for medical products.
4. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne & Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

.ADVANCED IMMUNOLOGY LAB

Course Code: MSB 320 **Credit Units: 01**

Course Contents:

1. Purification of immunoglobin G.
2. Study of antigen- antibody pattern (ODD).
3. Study of sandwich ELISA.
4. Study of haemeagglutination.
5. Study of immunoelectrophoresis.
6. Isolation and identification of rosette cells.
7. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ENZYME TECHNOLOGY LAB

Course Code: MSB 321 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: MSB 322 **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

1. Histological study of important animal tissues.
2. Estimation of enzyme activity from animal tissues.
3. Study of toxicity on invitro model.
4. Culture and maintenance of animal cell lines.
5. Culture of chicken fibroblasts.
6. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

1. Tissue culture lab and organization. Sterilisation of glasswares, tools and equipments.
2. Preparation of stocks and media. Surface sterilization of various explants
3. ORGAN CULTURE
4. Cllus culture
5. Anther culture
6. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED COMMUNICATION –III

Course Code: BCP 341 **Credit Units: 01**

Course Objective:

The course is designed to develop competence in communication skills related to production & presentation of messages in multiple formats & understand the importance of body language.
Prerequisites: NIL

Module I Written Communication	**40% Weightage**
• Coherence and Structure • Précis Writing • Writing Paragraphs & Essays	
Module II Developing Writing Skills	**30% Weightage**
• Business Letter/Official Correspondence • Social Correspondence • Emails & Netiquette	
Module III Business Presentations	**30% Weightage**
• Planning, Design and Layout of Presentation • Contents : Information Packaging & Delivery • Personal Branding	
Student Learning Outcomes	
The student will be able to write impressive official correspondence and also learn to make and give effective presentations in a professional environment.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	
Assessment/ Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994
Lesikar & Flatley, Basic Business Communication, Tata McGraw- Hill Edition

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)
Business Communication for Managers, Payal Mehra Pearson 2012
Additional Reading: Newspapers and Journal.

BEHAVIOURAL SCIENCE – III

Course Code: BSP-343 **Course Credit: 01**

Course Objective:

This course will help the students to:

- Importance of Personal and Professional excellence
- Inculcating the components of excellence
- Explore interest, attitude and Explore career opportunities
- Set career goals

Course Contents:

Module I: Professional Competence **(2 Hours)**

- Understanding Professional Competence
- Component of Competence:

  Knowledge
  Skills
  Attitude
  Self awareness
  Self Promotion & Presentation,
  Self confidence
  Skills
  Performance

- Political awareness, Coping with uncertainty
- Developing positive attributes at work place (personal and professional)
- Time management
- Handling criticism and interruptions
- Managing difficult people
-

Module II: Managing Personal Effectiveness **(2 Hours)**

- Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness)
- Integration of personal and organizational vision for effectiveness
- A healthy balance of work and play

Module III: Components of Excellence **(2 Hours)**

- Positive Imagination & Focused
- SMART Goal
- Controlling Distraction
- Commitment
- Constructive Evaluation
- Creativity & Success

Module IV: Career Development **(2 Hours)**

- Understanding Development Process
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude
- Selecting from available resources
- Career planning and development

Module V: Personal & Professional Success **(2 Hours)**

- Career Selection & Motivation.
- Action planning Networking Negotiation.
- Accept Change & Challenge for Successful career.

Student learning outcomes:

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers
- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan, D. (2005). Information and Knowledge Management, Macmillan India Ltd. Delhi

Français-III

CourseCode:FLP 344 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictools
- totalkaboutwork andproblemsrelatedtowork
- toperform simple communicative tasks(explaininga setback,askingforapostponementofappointment,give instructions,place orders,reserve, holda telephone conversation,write e-mails,replytomessages)
- toprepare arésumé andtoappearforinterviews

CourseContents:

Unité 5, 6:pp. 74to104

Actesde communication:

Unité 5:Travail

1. mangeraurestaurant,comprendreunmenu,commander
2. engagerune conversationtéléphonique
3. présentersonrésumé: parlerde sa formation,de sonexpérience,de ses compétences
4. raconterdesévénementspassés
5. consultersa boîte e-mails,répondreauxmessages

Unité 6:Problèmes

1. identifierunproblème,demanderdesprécisions
2. expliqueruncontretemps,déplacerunrendez-vous
3. demanderde l'aide (partéléphone,pare-mail)
4. donnerdesinstructions
5. expliquerunproblème,suggérerunesolution.

Grammaire :

1. futur proche, articles partitifs, un peu de, beaucoup de, une bouteille de, Un morceau de.
2. pronoms COD, venir de + infinitif, verbes appeler (au présent)
3. passé composé avec avoir, affirmatif et interrogatif, savoir et connaître
4. passé composé avec être, accord du participe passé, négation
5. pronoms COI, être en train de
6. ne…rien, ne…personne, ne…plus, ne…pas encore, qu'est-ce que/ qu'est-ce qui/qui est-ce que/qui est-ce qui.
7. passé composé des verbes pronominaux.
8. si/quand+présent, ne…plus, ne …pas encore.
9. impératif présent (2) place du pronom et verbes pronominaux.
10. Trop /pas assez, verbe devoir au conditionnel présent.

Examination Scheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage (%)	15	10	5	**30**	**70**	**100**

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

SUMMER INTERNSHIP

Course Code: MSB 350 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- ## Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- ## Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- ## Summary

- ## Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- ## References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: MSB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

The report should be hard bound and for color coding scheme refer NTCC guidelines.

It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?
Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY
MADHYA PRADESH

Master of Technology (Biotechnology)

Programme Code: MTB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2018 – 20

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAMME OBJECTIVE

Biotechnology is the technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.The main objective of this programme is to provide a balanced and comprehensive knowledge of the basic as well as applied sciences related to Biotechnology that would enhance the basic aptitude of each student and prepare them to take up the challenges in the varied and multi-faceted applications of Biotechnology. It will empower the students with the latest tools, techniques and awareness in biotechnology and will facilitate comprehensive learning combining the scientific and technological aspects

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB101	Biochemistry & Metabolic Regulation	4	-	-	4	
MTB102	Advanced Microbial Technology	4	-	-	4	
MTB103	Instrumentation in Biotechnology	4	-	-	4	
MTB104	Bioinformatics	4	-	-	4	
MTB105	Advance Biostatistics for Biologists	3	-	-	3	
MTB120	Biochemistry Lab	-	-	4	2	
MTB121	Microbiology Lab	-	-	2	1	
MTB122	Instrumentation in Biotechnology Lab	-	-	2	1	
MTB123	Bioinformatics Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB141	Advanced Communication	30	-	-		
MTB143	Self-Development for Interpersonal Skills	30	-	-		
 MTB144 MTB145 MTB146 MTB147 MTB148	Foreign Language - I French German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB201	Cell & Molecular Biology	4	-	-	4	
MTB202	Recombinant DNA Technology	4	-	-	4	
MTB203	Bioprocess Technology	4	-	-	4	
MTB204	Genomics & Proteomics	4	-	-	4	
MTB205	Pharmaceutical Biotechnology	3	-	-	3	
 MTB206 MTB207 MTB208 MTB209 MTB210 MTB211	**Elective-I (any one)** • Environmental Biotechnology • Biosensors • Artificial Neural Networks • Agriculture Biotechnology • Fundamentals of Computers & Programming in "C" • Bio-energy Engineering	3	-	-	3	
MTB220	Cell & Molecular Biology Lab	-	-	4	2	
MTB221	Recombinant DNA Technology Lab	-	-	4	2	
MTB222	Bioprocess Technology Lab	-	-	4	2	
MTB223	Genomics & Proteomics Lab	-	-	2	1	
	TOTAL				**29**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB241	Communicational for Employment	30	-	-		
MTB243	Conflict Resoultion and Management	30	-	-		
 MTB244 MTB245 MTB246 MTB247 MTB248	Foreign Language - II French German Spanish Japanese Chinese	30	-	-		

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SUMMER PROJECT: 8 - 10 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MTB301	Immunology & Immunotechnology	4	-	-	4	
MTB302	Enzymology & Enzyme Technology	4	-	-	4	
MTB303	Drug Design & Development	4	-	-	4	
MTB304	Bioprocess Plant Design	3	-	-	3	
 MTB305 MTB306 MTB307 MTB308 MTB309 MTB310	**Elective - II (any one)** • Pollution Prevention Fundamentals • Drug Delivery Systems • IPR, Biosafety & Bioethics • Advanced Food Technology • Industrial Safety & Management • Advanced Animal & Plant Cell Technology	3	-	-	3	
MTB320	Immunology & Immunotechnology Lab	-	-	4	2	
MTB321	Enzymology & Enzyme Technology Lab	-	-	2	1	
MTB360	Summer Project (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP341	Advanced Communication - III	30	-	-		
BSP343	Behavioural Science - III	30	-	-		
 FLP344 FLP345 FLP346 FLP347 FLP348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
MTB460	Project (20-22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **MTB 101** **Credit Units: 04**

Course Objective:

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

Course Contents:

Module I
Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II
Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III: Modes of Regulation
Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways
Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation, Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Biochemistry by A. Lehninger revised by Nelson and Cox.
- Biochemistry by Mathews, Van Holde and Ahern. IIIrd Edition.

References:

- “Biochemistry” by White, Handler and R.B. Smith 7th Ed. 1983
- Biochemistry” by L.Stryer Third Edition.
- Biochemistry by Voet and Voet.
- Fundamentals of Biochemistry by Conn and Stumph.

ADVANCED MICROBIAL TECHNOLOGY

Course Code: MTB 102 **Credit Units: 04**

Course Objective:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

Course Contents:

Module I

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

Module II

Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module III

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

Module IV

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

Module V

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill.
- Microbiology by Prescott.

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: MTB 103 **Credit Units: 04**

Course Objective:

To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Course Contents:

Module I: Ultracentrifugation
Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

Module II: Gel electrophoresis
Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

Module III
TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

Module IV
UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.

Module V
Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Module VI
Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:
- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John Wiley and Sons Ltd.
- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

BIOINFORMATICS

Course Code: **MTB 104** **Credit Units: 04**

Course Objective:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Course Contents:

Module I: Introduction and overview

The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.

Module II

Exact string matching -classical comparison based methods, semi numerical string matching, suffix trees - construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison

Module III

Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.

Module IV

Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees , estimating the rate of change, likelihood and trees; analysis software.

Module V

Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformaticsby C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MTB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

BIOCHEMISTRY LAB

Course Code: **MTB 120** **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity

Module II: Nucleic Acid
Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel.
Carbohydrate: Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar
Lipids: Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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MICROBIOLOGY LAB

Course Code: **MTB 121** **Credit Units: 01**

Course Contents:

Module I
Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

Module II
Biochemical test – Indole test, methyl red test, voges proskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: **MTB 122** **Credit Units: 01**

Course Objective:

To demonstrate the techniques used in the biotechnology for purification, characterization and identification of the proteins and other biotechnologically important products

Course Contents:

Module I: Cell disruption techniques

homogenization, sonication

Module II

Centrifugation – low speed and high speed.

Module III: Spectrophotometer techniques

Visible and UV spectrophotometry

Module IV

Chromatography-ion exchange, gel filtration and affinity columns, fraction collection, monitoring UV absorbance. Applications in enzyme purification.

Module V

Techniques for removal of salt/solvent from a sample -desalting, dialysis, ultrafiltration, speedvac, lyophilization etc.

Module VI

Electrophoresis –1 D (Polyacryamide gel electrophoresis and agarose) and 2D. Isoelectric focusing.

Module VII

Polarization and fluorescence microscopy

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOINFORMATICS LAB

Course Code: **MTB 123** **Credit Units: 01**

Course Objective:

To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

Course Contents:

Module I

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein

Module II

Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment
Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm

Module III

Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing

Module IV

Phylogenetic prediction and analysis

Module V

Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.

Module VI

Finding transcription regulatory signals

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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ADVANCED COMMUNICATION

Course Code: **MTB 141** **Credit Units: 01**

Course Objective:

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: **MTB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MTB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1 : Découvrir la langue française : (oral et écrit)

4. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
5. dire/interroger si on comprend
6. Nommer les choses

Unité 2: Faire connaissance

3. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
4. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

8. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
9. article indéfini, défini, contracté
10. nom, adjectif, masculin, féminin, singulier et pluriel
11. négation avec « de », "moi aussi", "moi non plus"
12. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
13. pronom tonique/disjoint- pour insister après une préposition
14. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

CELL AND MOLECULAR BIOLOGY

Course Code: **MTB 201** **Credit Units: 04**

Course Objective:

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

Course Contents:

Module I

Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.

Module II

Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.

Module III

Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.

Module IV: Replication

Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease.

Recombination & Repair: Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.

Module V

Transcription **-** RNA transcription and the proteins required for each step, maturation of the RNA transcript derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression

Module VI: Translation

Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Molecular Cell Biology by Bruce Albert
- Molecular Biology by Lodish Darnell and Baltimore
- Molecular Biology of the gene by Watson et al 4th ed.

References:

- Genes VIII by Benjamin Lewis
- Genetics by Ursula Goodenough
- Cytogenetics by l Garl P. Swanson, Mertz & Young
- Biochemistry by Stryer
- Genome by T.A. Brown, John Willey and Sons Inc.

RECOMBINANT DNA TECHNOLOGY

Course Code: **MTB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I
Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

Module II: Gene isolation
Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

Module III: Heterologous gene expression (bacteria and yeast)
Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

Module IV: Studying gene regulation and control
In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

Module V: Automation and robotic advances in RDT
DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation

Module VI: Laboratory, industrial and environmental applications of RDT
High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:
- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- "Gene Expression Technology" by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- "DNA Cloning: A Practical Approach" by D.M. Glover and B.D. Hames, IRL Press.

BIOPROCESS TECHNOLOGY

Course Code: MTB 203 Credit Units: 04

Course Objective:

The present course aims to aware about the requirements for large-scale cultivation of microbes for production of industrially important products with purification and characterization of these bioproducts using different techniques

Course Contents:

Module I

Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch.

Module II

Substrates for bioconversion processes and design of media, sterilization; Cell culture techniques; Inoculum development and aseptic transfers. Bioreactors – CSTR, CSTR in series , tower, loops, airlift bubble column & packed bed. Different types of pumps, valves, and line materials, piping convections etc. used in Biochemical Processes

Module III

Process technology for the production of primary metabolites, e.g. Baker's yeast, ethanol, citric acid, amino acids (lysine and glutamic acid). Microbial production of industrial enzymes (glucose isomerase, cellulase, amylase, lipase, protease) and secondary metabolites (penicillins, cephalosporins and streptomycin). Biomass (SCP and mushroom) production from agro-residues.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition , uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery , uses of various forms etc.

Streptomycin – chemical structure, production, harvest and recovery, use, by-product of streptomycin fermentation etc.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Glutamic Acid: Direct Fermentation, contribution of feed back control and regulation of cell permeability barrier for production.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Module IV

Characteristics of bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press.
- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
- Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, W.F. Veith, John Wiley and Sons Inc.
- Biochemical Engineering, S. Aiba, A.E. Humphrey and N.F. Millis, University of Tokyo Press.
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Process Engineering in Biotechnology, A.T. Jackson, Prentice Hall.
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering/ Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society.

GENOMICS AND PROTEOMICS

Course Code: **MTB 204** **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

GENOMICS

Module I: Introduction to Genomics
Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes
Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods.

Module III
Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module IV
Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.

Module V
Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.

Module VI
Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA : Structure and Function, Richard R. Sinden
- www.panimaText.com

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MTB 205** **Credit Units: 03**

Course Objective:
The main objectives are to cover representative pharmaceutical dosage forms, and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

Course Contents:

Module I
Introduction to Physical Pharmaceutics - Metrology and Calculations,

Module II
Molecular structure, properties and States of Matter, Solutions, Phase Equilibra, Micromeritic and Powder Rheology, Surface and Interfacial Phenomena, Dispersion Systems, Diffusion & Dissolution, Kinetics and drug stability, Viscosity & Rheology

Module III
Polymer Science and Applications, Formulations and Development, Packaging

Module IV
Introduction to Industrial Processing, Transport Phenomena (Fluid Flow, Heat Transfer and Mass Transfer)

Module V
Particulate Technology (Particle Size, Size reduction, Size Separation, Powder Flow and Compaction), Unit Operations (Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, and Drying)

Module VI
Materials of Pharmaceutical Plant Construction, Good Manufacturing Practice (GMP's) Guidelines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Bentley's Pharmaceutics by E A Rawlins
- Pharmaceutical Sciences by Remington

References:
- Physical Pharmacy by Alfred Martin.
- Cooper and Gunn's Tutorial Pharmacy

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MTB 206** **Credit Units: 03**

Course Objective:
To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I
Environmental components, Natural resources, Ecosystem and its diversity, Environmental pollution and its major impacts, Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Land degradation, Biomagnification

Module II
Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III
Biodegradation and bioremediation of major pollutants, Biomineralisation: Use of microbial technology for mining

Module IV
Waste water engineering: Treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V
Bioassessment of environmental quality: Biosensors and biomarkers, Biofertilizers, Biopesticides and Vermi composting

Module VI
Environmental impact assessment and Environmental audit, Related case studies from Indian market

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:
- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

BIOSENSORS

Course Code: MTB 207 Credit Units: 03

Course Objective:

On completion of the module students should Be able to Appreciate the basic configuration and distinction among biosensor systems, To gain an understanding of general biosensor principles and terms, To be able to design, model, simulate, fabricate, and test a biosensor, To gain an overall knowledge of biosensor types, applications, requirements, and capabilities to allow improved interaction with physicians, clinicians, and biomedical engineers, and to enable the student to conduct biomedical engineering research.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and transducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Affinity Biosensors: Techniques and Protocol by K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applications by V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors by B.R. Eggins, John Wiley and Sons Inc.

References:

- Sensors and Sensing in Biology and Engineering by F.G. Barth, wt al, Springer Verlag.
- Biosensors by Minh Canh. Tran
- Biosensors: Theory and Applications by Donald G. Buerk
- Enzyme and Microbial Biosensors: : Techniques and Protocols - by Kim R. Rogers, Ashok Mulchandani
- Biosensors in Environmental Monitoring - by Ursula Bilitewski, Anthony P. F. Turner.
- Biosensors: Micro electrochemical Devices - by Marc J. C. Lambrechts
- Biosensors with Fiberoptics - by Donald Lee Wise, Lemuel B. Wingard
- Biosensors and Their Applications - by That Tjien Ngo, Victor Chi-Min Yang
- Thermal Biosensors, Bioactivity, Bioaffinity -by Prakash K. Bhatia
- Novel Approaches in Biosensors and Rapid Diagnostic Assays - by Zvi Liron, Avraham Bromberg, Morly Fisher
- Biosensors - by Anthony E. G. Cass.

ARTIFICIAL NEURAL NETWORKS

Course Code: **MTB 208** **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, besides the closely related aspects of artificial neural networks.

Course Contents:

Module I
Historical background, Why is learning hard?

Module II
Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multilayer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning.

Module III
The back propagation algorithm, Aspects of Learning Theory and Generalization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?.

Module IV
Neural networks and analog VLSI, Selected Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Neural Networks: A Comprehensive Foundation by S. Haykin, Prentice Hall.

References:
- Neutral Networks for Pattern Recognition by C. Bishop, Oxford University Press.

AGRICULTURE BIOTECHNOLOGY

Course Code: **MTB 209** **Credit Units: 03**

Course Objective:

This course is designed to cover key concepts in the structure and manipulation of DNA and inheritance of genes, traditional plant breeding, current impact of biotechnology on crop production and its commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation.

Course Contents:

Module I
Sterilization; Nutrient medium; Callus & Suspension culture; canning, regulation; Micropropagation, production of virus free plants, anther culture, pollen culture; ovary culture, homozygous lines; meristem culture; somatic hybridization, somaclonal variation, germplasm conservation

Module II
Genetic engineering in plants, direct and indirect method of plant cell transformation, vectors with special reference to Ti plasmids, selectable markers, mechanism of T-DNA transfer to plants, transgenic plants, molecular maps and gene tagging, marker assisted selection

Module III
Applications of genetic engineering, insect and pest resistance, herbicide resistance, cytoplasmic male sterility in plants, molecular farming.

Module IV
Plant patents, plant variety certificates, safety regulation in transgenic plants.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:
- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

FUNDAMENTALS OF COMPUTERS AND PROGRAMMING IN 'C'

Course Code: **MTB 210** **Credit Units: 03**

Course Objective:

The main objectives of the course are to demonstrate familiarity with computer, show understanding of computer hardware and software, display basic understanding of computer programming processes, develop understanding of computer file management and protection principles, explain Internet, LAN and digital media fundamentals, define information systems analysis and design concepts, identify and demonstrate use of database concepts.

Course Contents:

Module I
Introduction to Digital Computer: Major components of a Digital Computer - Number system - Binary codes - Fixed and Floating Point representation - Logic gates - Flip flops - Registers - Input and Output Devices.

Module II: Introduction to programming
Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program.

Module III: Data Types
Variables - Constants - Arithmetic expressions - Use of operators - program examples.

Module IV: Decision making in C
Relational operators - Logical operators - Precedence of operators - IF and IF ... ELSE statements – Looping concepts in C _ WHILE loop - DO ... WHILE and FOR loops - Programming examples.
Functions: User defined Functions - Local and Global variables - Parameters - Programming examples.

Module V: Arrays
BREAK statement - Strings and character arrays - examples.
Pointers: Concept of Pointers - The Indirection operator - Use of Pointers in arrays - Programming examples.

Module VI: Structures
The period operator - Arrays of structures - Arrays within structures - Structures within structures - Pointers to structures - The arrow operator - Programming examples.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamentals of Computers by V. Rajaraman
- C Programming" by G. Kochan

References:
- Computer Fundamentals by B. Ram.
- The Spirit of C" by Mullish Cooper.

BIO-ENERGY ENGINEERING

Course Code: MTB 211 Credit Units: 03

Course Objective:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling.

Course Contents:

Module I: Biomass Sources, Characteristics & Preparation

Biomass Sources and Classification. – Chemical composition and properties of different biomass materials and bio-fuels – Sugar cane molasses and other sources for fermentation ethanol-Sources and processing of oils and fats for liquid fuels- Energy plantations

-Preparation of woody biomass: Size reduction, Briquetting of loose biomass, Drying, Storage and Handling of Biomass.

Module II: Biogas, Technology

Feedstock for biogas production, Aqueous wastes containing biodegradable organic matter, animal residues-. Microbial and biochemical aspects- Operating parameters for biogas production Kinetics and mechanism - Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.

Module III: Bio-Ethanol and Bio-Diesel Technology

Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

Module IV: Pyrolysis and Gasification of Biomass

Thermo-chemical conversion of ligno-cellulose biomass – Biomass processing for liquid fuel production - Pyrolysis of biomass-Pyrolysis regime, effect of particle size, temperature, and products obtained.

Thermo-chemical gasification principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidized Bed Gasifiers.

Module V: Combustion of Biomass and Cogeneration Systems

Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Fuels from Biomass and Wastes by D.L. Klass and G.M. Emert, Ann Arbor Science pub. Inc. Michigan,
- Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes by A. Chakraverthy, Oxford & IBH publishing Co., New Delhi,

References:

- Biogas Systems: Principles and Applications by K.M. Mital, New Age International Publishers (p) Ltd.,
- Biomass Energy Systems, by P. Venkata Ramana and S.N. Srinivas, Tata Energy Research Institute, New Delhi, 1996.
- Bio-gas Technology by Khandelwal K.C. and Mahdi, Tata McGraw-Hill pub. Co. Ltd., New Delhi
- Advances in bio-gas Technology by O.P. Chawla, I.C.A.R., New Delhi. 1970.

CELL AND MOLECULAR BIOLOGY LAB

Course Code: **MTB 220** **Credit Units: 02**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

8. Isolation of genomic DNA from prokaryotic and Eukaryotes
9. Isolation of plasmid.
10. Study of apoptosis by TUNEL method
11. Isolation of cell organelles by ultracentrifugation.
12. Study of in vitro transcription.
13. Study of DNA repair mechanism
14. Site-directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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RECOMBINANT DNA TECHNOLOGY LAB

Course Code: **MTB 221** **Credit Units: 02**

Course Contents:

8. Preparation and Transformation of competent cells by $CaCl_2$ method.
9. Restriction digestion
10. Legation
11. Southern hybridization
12. Western blotting
13. RFLP
14. PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOPROCESS TECHNOLOGY LAB

Course Code: MTB 222 Credit Units: 02

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

GENOMICS AND PROTEOMICS LAB

Course Code: MTB 223 Credit Units: 01

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Analysis of 2D – IEF data

Module IV

Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MTB 241** **Credit Units: 01**

Course Objective:
To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: **MTB 243** **Credit Units: 01**

Course Objective:
This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MTB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

4. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
5. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
6. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

5. situer un lieu
6. s'orienter, s'informer sur un itinéraire.
7. Chercher, décrire un logement
8. connaître les rythmes de la vie

Unité 5: s'informer

5. demander/donner des informations sur un emploi du temps passé.
6. donner une explication, exprimer le doute ou la certitude.
7. découvrir les relations entre les mots
8. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
7. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
8. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
9. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
10. passé composé
11. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: **MTB 301** **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I

Phylogeny of Immune System, Types of immunity clonal nature of immune response. Organization and structure of lymphoid organs. Antibody structure and function. Major histocompatibilty: Complex BCR and TCR, generation of antibody diversity, Complement system

Module II: Cells of the immune system

Hematopoiesis and differentiation, antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance.

Module III

Cell mediated toxicity, Hypersensitivity, Autoimmunity, Vaccines: General considerations, ideotype network hypothesis

Module IV

Tumor immunology, Transplantation immunology, Immunotheropy.

Module V

Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, (FACS) Hybridoma technology and its application

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Immunology by J. Kubey Fence Creek Publishing (Blackwell).
- Immunology by Ivan Riott

References:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: **MTB 302** **Credit Units: 04**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
General characteristics of enzymes, Mechanism of action of few enzymes: lysozyme, ribozymes, chymotrypsin and alcohol dehydrogenase.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Multisubstrate systems, Enzyme Inhibitors as therapeutic agents, active site, Isozyme and multienzyme complex.

Module III: Applications of enzymes
Clinical and Industrial, Enzyme Immobilization and its applications.

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice of reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies, Thermostable enzymes with special references to amylases, lipases and proteases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems by I.H. Segel, Wiley-Interscience
- Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis by R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis by R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer
- Industrial Enzymes & their applications by H. Uhlig, John Wiley and Sons Inc.

DRUG DESIGN AND DEVELOPMENT

Course Code: **MTB 303** **Credit Units: 04**

Course Objective:
The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification
DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II
Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III
Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV
Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR
Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Introduction to Biophysical Methods for Protein and Nucleic Acid Research by J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action" by W.B. Pratt and P. Taylor, Churchill Livingston.

References:

- Principles of Medicinal Chemistry" by W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins.
- Side Effects and Drug Desig by E.J. Lien, Marcel Dekker
- The Anticancer Drugs by W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.

BIOPROCESS PLANT DESIGN

Course Code: MTB 304 Credit Units: 03

Course Objective:

The objective of this paper is to include the application of chemical engineering principles/unit operations to bioprocess systems and the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I
Introduction; general design information; Mass and energy balance.

Module II
Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment.

Module III
Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment.

Module IV
Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries.

Module V
Design of facilities for cleaning of process equipment used in biochemical industries.

Module VI
Utilities of biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Applied Process Design for Chemical and Petrochemical Plants by E.E. Ludwig, Butterworth-Heinemann.
- Chemical Engineering by R.K. Sinnott, J.M. Coulson and J.F. Richardson, Butterworth-Heinemann.

References:
- Chemical Engineers Handbook by R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling by F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers by M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design by E. Bausbacher and R. Hunt, Prentice Hall PTR.

POLLUTION PREVENTION FUNDAMENTALS

Course Code: **MTB 305** **Credit Units: 03**

Course Objective:
To develop an understanding of the methods and impacts of waste minimization including waste pollution prevention and recycling, obtain an overview of relevant environmental laws and regulations governing waste management, understand the phenomena and environmental impact of green-house gases and alternative energy sources to reduce the effect of global warming.

Course Contents:

Module I: Pollution Prevention in Industries
Environment friendly chemical processes-Properties and fates of environmental contaminants- Regulations for clean environment and implications for industries – Improved Manufacturing Operations.

Module II: Life Cycle Assessment and Environmental Audit
Life cycle assessment and pollution prevention economics-Hazard and risk Analysis - Pollution prevention planning - Design for the environment.

Module III: Conservation of Materials and Energy
Water energy and reagent conservation – Residuals management –
Economic Recovery and Recycling of Wastes - Case studies.

Module IV: Total Quality Environment Management and Ems 14000
Municipal pollution prevention programmes –Environment Management System-14000- Systematic, Structured and Documented Response to Environmental Issues- Auditable and Time Targeted Environmental Improvement Programs.

Module V: Hierarchy of Environment Management Practices
Waste-specific pollution prevention: waste pre - generation focus on minimization / recycling, Waste-specific pollution control treatment: pre – generation focus on disposal/ recycling- Waste-specific Post-release-to environment focus: recycling/ remediation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Pollution Prevention: Fundamentals and Practice by Bishop P., McGraw-Hill International Edition, McGraw-Hill book Co, Singapore
- Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner,, Oxford University Press. N.Y.

References:
- Chemical Technology for better Environment by T.K. Roy, (Editor), Allied publishers Ltd, Chennai
- Pollution Prevention through Process Integration: Systematic Design Tools by El Halwagy, M.M, Academic Press, N.Y.

DRUG DELIVERY SYSTEMS

Course Code: **MTB 306** **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MTB 307** **Credit Units: 03**

Course Objective:

The objectives of the course are to explain the fundamental principles of IPR issues and examine information policy issues from different perspectives. Students will study and assess policy groups, intellectual property rights, access to information and research policy issues that usually include plant, animal and microbial genetic engineering products

Course Contents:

Module I

Objectives of Intellectual Property Rights, origin and evolution of IPR, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Patent, Industrial Design, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties

Module II: IPR

National and international perspective, TRIPS and WIPO

Module III: Patent

Basic criterion for patentability, patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and international perspective, Case study: Basmati case, Neem controversy, Turmeric Case

Module IV: Biosafety

Definition and requirement; biosafety in relation to human health, environment, transgenic research and applications, biosafety laws, guidelines and conventions, biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule ; Regulation bodies at National and International level

Module V

Legal and socioeco'nomic impact of the products and techniques in Biotechnology, Bioethics in plant, animal and microbial genetic engineering, Ethical issues in healthcare, Biopiracy and ethical conflicts

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Coyles information highway handbook; A Practical File on the New Information Order, American Library Association, 2000.
- American Indian Cultural & Research Journal *(UCLA)*

References:

- Refer to Periodicals, Industry directories, Articles and report in journals on the regulatory issues, "Biotechnology" series by Rehm & Reed.

ADVANCED FOOD TECHNOLOGY

Course Code: **MTB 308** **Credit Units: 03**

Course Objective:

The purpose of the Food Technology major is to produce professionals with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research

Course Contents:

Module I

Processing and preservation technologies used in the food industry: heating, drying and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies

Module II

Micro-organisms and their metabolites for food, feed and fuel, development and application of food enzymes: fungal amylases, alpha-amylase, pectinase, amyloglucosidase and catalase. Technology for improvement of the quality of fruit juice through enzymatic treatment, Food spoilage and food poisoning micro-organisms

Module III

Pre- and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage

Module IV

Development of environment-friendly packaging materials based on product characteristics and performance properties of packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminium containers, and retortable pouches based on heat penetration studies and sterilization value

Module V

Food Safety in food service Establishment and other food areas

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Food Technology by Fraziar
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Evaluation Of Certain Food Additives And Contaminants, (WHO Technical Report Series 901) World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland
- International Journal of Food Science & Technology, Blackwell synergy publication
- Bioterrorism and Food Safety by Rasco and Bledsoe.

INDUSTRIAL SAFETY AND MANAGEMENT

Course Code: **MTB 309** **Credit Units: 03**

Course Objective:
Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Course Contents:

Module I: Hazards
Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

Module II: Psychology and Hygiene
Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control
Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management
Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

Module V: Laws
Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S .Wood Wiley Interscience,

References:
- Industrial Safety and Laws by Indian School of Labour Education, Madras.

ADVANCED ANIMAL AND PLANT CELL TECHNOLOGY

Course Code: **MTB 310** **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

ADVANCED ANIMAL CELL TECHNOLOGY

Module I

Brief history of animal cell and organ culture, Cultivation of animal cell *en masse* in bioreactor, methods for scale-up, immobilized cell culture, insect cell culture, somatic cell culture, organ culture, and embryo culture.

Module II

Valuable products from cell culture, Production of recombinant tissue-plasminogen-activator, blood factor VIII, erythropoietin, insulin, somatostatin, somatotropin.

Module III

Hybridoma technology, Monoclonal antibodies- production and application, Stem cell technology, custom made animals and tissue engineering

ADVANCED PLANT CELL TECHNOLOGY

Module IV

Brief introduction to various tissue culture techniques,

Cell Cultures, regeneration and preservation: Plant regeneration through meristem, callus (somatic embryogenesis) and anthers. Protoplast culture and somatic hybridization. Production, preservation and use of somatic embryos. Artificial Seeds and Cybrids.

Module V

Induction & utilization of somatic variants; Secondary metabolite production through cell cultures. Principles and the technology, pharmaceutical, secondary metabolites & beverage production; Commercialization of tissue culture technology (Micropropagation). Plant cell reactors. Immobilized plant cell reactors

Module VI

Engineering of Chloroplast and mitochondrial genomes and their applications, Biotransformation by plant cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: **MTB 320** **Credit Units: 02**

Course Objective:

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

Course Contents:

Module I

Blood film preparation and identification of cells, Identification of blood group, Isolation of serum.

Module II

Lymphoid organs and their microscopic organization.

Module III

WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test, ELISA:- DOT, SANDWICH

Module IV

Purification of IgG through affinity chromatography

Module V

Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code: **MTB 321** **Credit Units: 01**

Course Objective:

To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells

Course Contents:

Module I

Isolation of Enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, acid phosphatase, cellulase, protease.

Module III

Production of enzyme on industrial scale using solid and liquid-state fermentation.

Module IV

Purification of enzyme by ammonium sulphate fractionation, ion-exchange, gel permeation chromatography.

Module V

Enzyme Kinetics: Determination of Michaelis-Menten constant (Km) and Maximum Velocity (Vmax), Temperature optima and pH optima of an enzyme.

Module VI

Enzyme immobilization and its effect on enzyme activity

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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PROFESSIONAL COMMUNICATIONAL SKILLS

Course Code: MTB 341 **Credit Units: 01**

Course Objective:

To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

Course Contents:

Module I: Mechanics and Semantics of Sentences
Writing effective sentences
Style and Structure

Module II: Developing writing skills
Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

Module III: Business Presentations
Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

LEADING THROUGH TEAMS

Course Code: **MTB 343** **Credit Units: 01**

Course Objective:

This course aims to enable students to:
Understand the concept and building of teams
Manage conflict and stress within team
Facilitate better team management and organizational effectiveness through universal human values.

Course Contents:

Module I: Teams: An Overview
Team Design Features: team vs. group
Effective Team Mission and Vision
Life Cycle of a Project Team
Rationale of a Team, Goal Analysis and Team Roles

Module II: Team & Sociometry
Patterns of Interaction in a Team
Sociometry: Method of studying attractions and repulsions in groups
Construction of sociogram for studying interpersonal relations in a Team

Module III: Team Building
Types and Development of Team Building
Stages of team growth
Team performance curve
Profiling your Team: Internal & External Dynamics
Team Strategies for organizational vision
Team communication

Module IV: Team Leadership & Conflict Management
Leadership styles in organizations
Self Authorized team leadership
Causes of team conflict
Conflict management strategies
Stress and Coping in teams

Module V: Global Teams and Universal Values
Management by values
Pragmatic spirituality in life and organization
Building global teams through universal human values
Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - III

Course Code: **MTB 344** **Credit Units: 02**

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

4. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
5. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
6. parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

4. maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
5. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
6. caractériser une personne (aspect physique et caractère)

Contenu grammatical:

11. accord des adjectifs qualificatifs
12. articles partitifs
13. Négations avec de, ne…rien/personne/plus
14. Questions avec combien, quel…
15. expressions de la quantité
16. ne…plus/toujours - encore
17. pronoms compléments directs et indirects
18. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
19. Impératif avec un pronom complément direct ou indirect
20. construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

SUMMER PROJECT

Course Code: MTB 360 Credit Units: 12

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

4. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

4.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

4.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

4.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

4.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

4.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

4.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

4.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

4.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

4.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

4.10 List of Acronyms and Standards

4.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

4.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

4.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

5. Production of Project Report

5.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

5.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

5.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

5.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

5.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

6. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

6.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

6.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

6.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

6.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

PROJECT

Course Code: **MTB 460** **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(vi) Long Tables
(vii) Long quotations
(viii) Foot notes
(ix) Multilane captions
(x) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

 Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor’s Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar’s signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:
For Journals

[6] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[7] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[8] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[9] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[10] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[10] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[11] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[12] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Assessment Scheme:

Continuous Evaluation: 40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

AMITY UNIVERSITY

MADHYA PRADESH

Bachelor of Technology (Biotechnology)

Programme Code: BTB

Duration – 4 Years Full Time

Programme Structure

And
Curriculum & Scheme of Examination

Batch: 2019 – 2023

AMITY UNIVERSITY

MAHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2019

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

Old Course Code	New Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses							
BTB 101	BTB 101	Applied Mathematics - I	3	1	-	4	
BTB 103	CHE 101	Applied Chemistry	3	1	-	4	
BTB 104	CSE 104	Programming for Problem Solving	2	1	-	3	
BTB 105	BTB 105	Life Sciences-I	2	1	-	3	
BTB 121	CHE 121	Applied Chemistry Lab	-	-	2	1	
BTB 122	CSE 124	Programming for Problem Solving Lab	-	-	4	2	
BTB 123	BTB 123	Engineering Graphics Lab	-	-	2	1	
BTB 142	EVS 142	Environmental Studies - I	2	-	-	2	
		TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three [Hours per Sem]							
BTB 141	BCU 141	Communication Skill - I	30	-	-		
BTB 143	BSU 143	Behavioural Science - I	30	-	-		
 BTB 144 BTB 145 BTB 146 BTB 147 BTB 148	 FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses							
BTB 201	BTB 201	Applied Mathematics – II	3	1	-	4	
BTB 202	PHY 101	Applied Physics - I	3	1	-	4	
BTB 204	CSE 204	Object Oriented Programming Using C++	2	1	-	3	
BTB 205	ECE 101	Electrical Sciences	3	-	-	3	
BTB 206	BTB 206	Life Science-II	3	-	-	3	
BTB 220	PHY 121	Applied Physics Lab – I	-	-	2	1	
BTB 222	CSE 224	Object Oriented Programming Using C++ Lab	-	-	2	1	
BTB 223	ECE 121	Electrical Sciences Lab	-	-	2	1	
BTB 242	EVS 242	Environmental Studies - II	2			2	
		TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hours/Sem)							
BTB 241	BCU 241	Communication Skill - II	30	-	-		
BTB 243	BSU 243	Behavioural Science - II	30	-	-		
		Foreign Language - II	30	-	-		
BTB 244	FLU 244	French - II					
BTB 245	FLU 245	German					
BTB 246	FLU 246	Spanish					
BTB 247	FLU 247	Japanese					
BTB 248	FLU 248	Chinese					

TERM PAPER DURING SUMMER BREAK

THIRD SEMESTER

Compulsory Courses							
BTB301	BTB301	Cell Biology	3	-	-	3	
BTB302	BTB302	Biochemistry - I	3	-	-	3	
BTB303	BTB303	Microbiology	3	1	-	4	
BTB304	BTB304	Molecular Biology	3	1	-	4	
BTB305	CSE 202	Data StructuresThrough C++	3	-	-	3	
BTB320	BTB320	Cell Biology Lab	-	-	2	1	
BTB321	BTB321	Biochemistry Lab - I	-	-	2	1	
BTB322	BTB322	Microbiology Lab	-	-	2	1	
BTB323	BTB323	Molecular Biology Lab	-	-	2	1	
BTB324	CSE 222	Data Structures Through C++ Lab	-	-	2	1	
BTB330	BTB330	Term Paper (Evaluation)	-	-	-		
		TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hours/Sem)							
BTB341	BCU341	Communication Skill - III	30	-	-		
BTB343	BSU 343	Behavioural Science - III	30	-	-		
		Foreign Language - III	30	-	-		
BTB344	FLU 344	French - III					
BTB345	FLU 345	German					
BTB346	FLU 346	Spanish					
BTB347	FLU 347	Japanese					
BTB348	FLU 348	Chinese					

FOURTH SEMESTER

Compulsory Courses							
BTB401	BTB401	Biochemistry – II	3	1	-	4	
BTB402	BTB402	Genetics	3	1	-	4	
BTB403	BTB403	Methods & Instrumentation in Biotechnology	3	-	-	3	
BTB405	BTB404	Chemical Biology	2	1	-	3	
BTB404	CSE 304	Database Management Systems	3	-	-	3	
BTB420	BTB420	Biochemistry Lab - II	-	-	2	1	
BTB421	BTB421	Genetics Lab	-	-	2	1	
BTB422	BTB422	Methods & Instrumentation in Biotechnology Lab	-	-	2	1	
BTB423	CSE 324	Database Management Systems Lab	-	-	2	1	
		TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three (Hours/Sem)							
BTB441	BCU 441	Communication Skill - IV	30	-	-		
BTB443	BSU 443	Behavioural Science - IV	30	-	-		
 BTB444 BTB445 BTB446 BTB447 BTB448	 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT I – (6 - 8 WEEKS)

FIFTH SEMESTER

Compulsory Courses							
BTB501	BTB501	Plant Biotechnology	3	-	-	3	
BTB502	BTB502	Animal Biotechnology	3	-	-	3	
BTB506	BTB503	Structural Biology	3	-	-	3	
BTB504	BTB504	Chemical Engineering Principles	3	-	-	3	
BTB505	BTB505	Basic Bioanalytical Techniques	3	-	-	3	
BTB503	CSE 403	Java Programming	3	-	-	3	
BTB520	BTB520	Plant Biotechnology Lab	-	-	2	1	
BTB521	BTB521	Animal Biotechnology Lab	-	-	2	1	
BTB523	BTB522	Structural Biology Lab	-	-	2	1	
BTB522	CSE 423	Java Programming Lab	-	-	4	2	
BTB560	BTB560	Summer Project – I (Evaluation)	-	-	-	5	
		TOTAL				**28**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BTB541	BCU 541	Communication Skill – V	30	-	-		
BTB543	BSU 543	Behavioural Science - V	30	-	-		
 BTB544 BTB545 BTB546 BTB547 BTB548	 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Cumpulsory Courses							
BTB601	BTB601	Recombinant DNA Technology	3	-	-	3	
BTB602	BTB602	Enzymology & Enzyme Technology	3	-	-	3	
BTB603	BTB603	Immunology & Immunotechnology	3	1	-	4	
BTB604	BTB604	Computational Biology	3	-	-	3	
BTB605	BTB605	Fundamentals of Biochemical Engineering	3	-	-	3	
BTB620	BTB620	Recombinant DNA Technology Lab	-	-	2	1	
BTB621	BTB621	Enzymology & Enzyme Technology Lab	-	-	2	1	
BTB622	BTB622	Immunology & Immunotechnolgy Lab	-	-	2	1	
BTB623	BTB623	Computational Biology Lab	-	-	2	1	
		TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BTB641	BCU 641	Communication Skill - VI	30	-	-		
BTB643	BSU 643	Behavioural Science - VI	30	-	-		
 BTB644 BTB645 BTB646 BTB647 BTB648	 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT - II – (6 - 8 WEEKS)

SEVENTH SEMESTER

Compulsory Courses							
BTB701	BTB701	Bioprocess Technology	3	-	-	3	
BTB702	BTB702	Downstream Processing	3	-	-	3	
BTB703	BTB703	Statistics for Biology	3	-	-	3	
  BTB704 BTB705 BTB706 BTB707 BTB708 BTB709 BTB710	 BTB704 BTB705 BTB706 BTB707 BTB708 BTB709 BTB710	**Elective (Anyone of the following 8)** • Thermodynamics of Biological Systems • Pharmaceutical Chemistry & Drug Design • Current Topics in Biotechnology • Environmental Biotechnology • Bioprocess Plant Design • Artificial Neural Networks • Biosensors	3	-	-	3	
BTB704	CSE 504	Advanced Java Programming	3	-	-	3	
BTB720	BTB720	Bioprocess Technology Lab	-	-	2	1	
BTB722	BTB721	Downstream Processing Lab	-	-	2	1	
BTB721	CSE 524	Advanced Java Programming Lab	-	-	2	1	
BTB760	BTB760	Summer Project - II (Evaluation)	-	-	-	6	
		TOTAL				**24**	

EIGHTH SEMESTER

Compulsory Courses								
BTB801	BTB801	Genomic & Proteomics	3	1	-	4	
BTB802	BTB802	Drug Delivery Systems	3	-	-	3	
BTB804	BCH 621	Management, Accounting & Cost Control	1	-	-	1	
BTB803	BCH 622	Project Management	1	-	-	1	
BTB805	BCH 623	Principles of Management & Enterprenurship Development	1	-	-	1	
BTB806	CSE 804	ASP.NET	3	-	-	3	
BTB820	BTB820	Genomic & Proteomics Lab	-	-	2	1	
BTB821	CSE 824	ASP.NET	-	-	2	1	
BTB860	BTB860	Major Project (10-12 Weeks)	-	-	-	16	
		TOTAL				**31**	

Curriculum & Scheme of Examination

APPLIED MATHEMATICS – I

Course Code: BTB 101 **Credit Units: 04**

Course Objective:
The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Differential Calculus
Derivative of a function, Derivatives at a point, Fundamental rules for differentiation: Product Rule, Quotient Rule and Chain Rule, Differentiation of Implicit Functions, Parametric forms and Logarithmic Differentiation, Successive differentiation, Leibnitz's theorem (without proof), Mean value theorem, Taylor's and Maclaurin's Theorem, Asymptote & Curvature, Partial Differentiation, Euler's Theorem, Maxima and Minima

Module II: Integral Calculus
Fundamental Integral Formulae, Methods of Integration: Integration by Substitution, By Parts, Partial Fractions, Definite Integral and its Properties, Reduction Formulae, Application to length, Area and Volume.

Module III: Ordinary Differential Equations
Definition of Order and Degree of differential equation, Formation of ODEs, Solution of Differential Equation of 1st Order and 1st Degree: Variable Separation, Homogeneous Differential Equations, Linear Differential Equations, Exact Differential Equations, General Linear ODE of Second Order, Solution of Homogeneous Equation, Solution of Simple Simultaneous ODE

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Differential Calculus by Shanti Narain
- Integral Calculus by Shanti Narain

References:
- Differential Equation by A.R.Forsyth
- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - I (FIELDS AND WAVES)

Course Code: BTB 102 **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I: Electrostatics
Brief introduction of Vectors, gradient of a scalar field, divergence and curl of vector field, Electric flux, Gauss's law, Statements of Gauss divergence and Stokes theorem

Module II: Relativity
Michelson-Morley experiment, Inertial & non-inertial frames, Special theory of Relativity, Relativistic space-time transformation, Transformation of velocity, Variation of mass with velocity, Mass-energy equivalence

Module III: Oscillations & Waves
Simple harmonic motion – equation and energy conservation, superposition of two SHMs, Lissajous figures, damped and forced oscillations – equations, amplitude and frequency response, LCR Circuit, resonance, sharpness of resonance, equation of motion for plane progressive waves, superposition of waves

Module IV: Wave Nature of Light
Interference: Conditions of interference, division of wavefront, Fresnel's biprism, division of amplitude, interference due to thin films, Newton's rings
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, Transmission grating and its resolving power.
Polarization: Birefringence, Nicol prism, Production and analysis of plane, circularly and elliptically polarized light, Half and quarter wave plates, Optical rotation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Waves & oscillation, A. P. French
- Physics of waves, W. C. Elmore & M. A. Heald
- Introduction to Electrodynamics, D. J. Griffith
- Electrodynamics, Gupta, Kumar & Singh
- Optics, A. K. Ghatak
- Engineering Physics, Satya Prakash

APPLIED CHEMISTRY- I

Course Code: BTB 103 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Chemical Bonding
Types of bond: Ionic, Covalent and Co-ordinate bond; Fajan's rule; Hybridisation; H- bonding ; Valence bond and Molecular orbital theory for diatomic molecule.

Module II: Organic Mechanism
Electronegativity and dipole moment; Electron Displacement Effects: Inductive Effect; Mesomeric Effect; Electromeric Effects; Fission of covalent bonds; Intermediates of Organic reactions; Carbonium, Carbanion, Free Radical and Carbene; Types of organic reactions; Substitution, Elimination, Addition.

Module III: Instrumental method for Analysis
Introduction; Principles of spectroscopy; Law's of Absorbance; IR: Principle Instrumentation; Application; UV: Principle, Instrumentation and Application; NMR Principle and Instrumentation; Application; Chromatography; GC: Principle, Instrumentation and Application; HPLC: Principle, Instrumentation and Application.

Module IV: Thermodynamics
Introduction; Terminology; First Law; Heat Capacity; Calculation of thermodynamic quantities; Adiabatic and Isothermal Process; Reversible and Irreversible Process; Second law of Thermodynamics; Standard State; Gilbb's Helmholtz equation; VantHoff Isotherm and Isochore; Maxwell Relation; Third law of Thermodynamics; Chemical Potential; Activity and Activity Coefficient; Coupled Reactions.

Module V: Chemical Equilibrium
Introduction ; Le Chatelier's Principle; Equilibrium constant from Thermodynamic Constants; Acid-Base Concept; Weak acid and Weak base and their salts; Solubility Product; pH and pOH, Buffer Solution, Buffer Action.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Engineering Chmistry, Jain & Jain
- Engineering Chmistry, Shashi Chawla

References:
- Organic Mechanism, Morrison and Boyd
- Physical Chemistry, Puri Sharma and Pathania
- Organic Chemistry Vol-I, IL Finar
- Organic Chemistry Vol-II, IL Finar
- Physical Chemistry, Atkins Peter, Paula Julio
- A guide to mechanism in organic chemistry, Peter Sykes.
- Introduction to practical chemistry, K.K.Sharma
- Concise Inorganic chemistry, J.D. Lee

INTRODUCTION TO COMPUTERS

Course Code: BTB 104 **Credit Units: 03**

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction

Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types), H/W concepts (I/O Devices), S/W concepts (System S/W & Application S/W, utilities). Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C

History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Precedence of Arithmetic operators, Operator precedence of Arithmetic Operators, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C

C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types(automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions

One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations.
Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C

Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments.
Strings and C string library.
Structures and Unions. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments.
File Handling.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Yashwant Kanetkar, “Let us C”, BPB Publications, 2nd Edition, 2001.
- “ANSI C” by E Balagurusamy.
- Herbert Schildt, “C: The complete reference”, Osbourne Mcgraw Hill, 4th Edition, 2002.
- V.Raja Raman, “Computer Programming in C”, Prentice Hall of India, 1995.

***References*:**

- Kernighan & Ritchie, “C Programming Language”, The (Ansi C Version), PHI, 2nd Edition.
- J.B. Dixit, “Fundamentals of Computers and Programming in ‘C’.
- P.K. Sinha and Priti Sinha, “Computer Fundamentals”, BPB publication.

LIFE SCIENCES-I

Course Code: BTB 105 **Credit Units: 03**

Course Objective:

The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata and classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Invertebrates

Saileats features and outline classification of various phyla of invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II: Vertebrates

Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module-III: Lower Plants

Systematic: Recent trends in classification of Algae, Fungi, Bryophyte and Pteridophytes.

General account: Characteristic features; mode of reproduction and life cycles in Algae; Fungi including Lichens and Mycorrhiza; Bryophyte and Pteridophytes.

Economic Importance: Industrial applications; Ecological significance; Importance in agriculture.

Module-IV: Higher Plants

Systematics: Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority; Effective and valid publication; Author Citation. Broad outline of Bentham & Hooker, D.D Pant's classification

General account: General characteristic features, Distribution, mode of reproduction and generalised life cycles of Gymnosperms and Angiosperms.

Economic Importance: Industrial and ecological importance of Gymnosperms and Angiosperms

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Fundamentals of Environmental Chemistry, G.S.Sodhi, Narosa Publishers.
- Introduction to Environmental Pollution, B.K Sharma, H.Kaur, Goel Publishers.
- Biochemistry Styrier.
- Cell Biology, C B Pawar.
- Biochemistry, Lalinger.
- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain, Rastogi Publication.
- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.

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APPLIED PHYSICS LAB - I

Course Code: BTB 120 **Credit Units: 01**

List of Experiments

14. To determine the wavelength of sodium light by Newtons's rings method.
15. To determine the dispersive power of the material of prism with the help of a spectrometer.
16. To determine the specific rotation of sugar by Bi-quartz or Laurent half shade polarimeter.
17. To determine the speed of ultrasonic waves in liquid by diffraction method.
18. To determine the width of a narrow slit using diffraction phenomena.
19. To determine the temperature coefficient of platinum wire, using a platinum resistance thermometer and a Callender & Grif/fth's bridge.
20. To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
21. To determine the internal resistance of Leclanche cell with the help of Potentiometer.
22. To determine the resistance per unit length of a Carey Foster's bridge wire and also to find out the specific resistance of a given wire.
23. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.
24. To determine the value of acceleration due to gravity ("g") in the laboratory using bar pendulum.
25. To determine the moment of inertia of a flywheel about its own axis of rotation.
26. To determine the density of material of the given wire with the help of sonometer

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - I

Course Code: BTB 121 **Credit Units: 01**

List of Experiments

1. Titration of phosphoric acid and sodium hydroxide solution using pH meter.
2. Verification and application of Beer's Law.
3. Spectroscopic analysis of iron in water sample.
4. Conductometric titration.
5. Determination of water modules of crystallization in Mohr's salt.
6. (A) Determination of surface Tension of liquid.
   (B) Application of surface tension method in mixture analysis.
7. Application of distribution law in the determination of equilibrium constant.
8. Analysis of iron ore.
9. Plant pigments separation by paper chromatography.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PROGRAMMING IN C LAB

Course Code: BTB 122 **Credit Units: 01**

Software Required: Turbo C

Course Contents:

Module I

DOS commands

Module II

Creation of batch files

Module III

C program involving problems like finding the nth value of cosine series, Fibonacci series etc.

Module IV

C programs including user defined function calls

Module V

C programs involving pointers, and solving various problems with the help of those.

Module VI

File handling

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ENGINEERING GRAPHICS LAB

Course Code: BTB 123 **Credit Units: 01**

Course Objective:

This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines

Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures

Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids

Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI: Development of Surface

Development of simple objects with and without sectioning. Isometric Projection

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

- M.B. Shah & B.C. Rana, Engineering Drawing, Pearson Education, 2007
- PS Gill, Engineering Drawing, Kataria Publication
- ND Bhatt, Engineering Drawing, Charotar publications
- N Sidheshwar, Engineering Drawing, Tata McGraw Hill
- CL tanta, Mechanical Drawing, "Dhanpat Rai"

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: BTB 141 **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	**A**	**CT**	**HA**	**EE**
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

*** 30 hrs Programme to be continued for Full year**

ENVIRONMENTAL STUDIES - I

Course Code: BTB 142 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem

Structure and function of an ecosystem

Producers, consumers and decomposers

Energy flow in the ecosystem

Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

e. Forest ecosystem
f. Grassland ecosystem
g. Desert ecosystem
h. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

Biodiversity at global, national and local levels

India as a mega-diversity nation

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts

Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: BTB 143 **Credit Units: 01**

Course Objective:

This course aims at imparting:
Understanding self & process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effective on personality
Building Emotional Competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning and Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and nature of attitude
Components and Types of attitude
Importance and relevance of attitude

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, components, Importance and Relevance
Positive and Negative emotions
Healthy and Unhealthy expression of emotions

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - I

Course Code:BTB 144 **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

4. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
5. dire/interroger si on comprend
6. Nommer les choses

Unité 2: Faire connaissance

3. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
4. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

8. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
9. article indéfini, défini, contracté
10. nom, adjectif, masculin, féminin, singulier et pluriel
11. négation avec « de », "moi aussi", "moi non plus"
12. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
13. pronom tonique/disjoint- pour insister après une préposition
14. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

APPLIED MATHEMATICS – II

Course Code: BTB 201 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from athematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Linear Algebra

Definition of a Matrix, Operations on Matrices Determinants, Elementary Operations, Reduction of a Matrix to Row Echelon Form, Rank of a Matrix, Consistency of Linear Simultaneous Equations, Gauss Elimination and Gauss Jordan – Method, Eigen values and Eigen Vectors of Matrix, Caley-Hamilton theorem, Diagonalization of a matrix.

Module II: Complex Number

Definition of Complex Number, Equality, Conjugate and Modulus of a Complex Number, Polar form of a Complex Number, De-Moivre's Theorem, Roots of a Complex Number, Exponential and Circular function of a Complex Number, Hyperbolic Functions and their inverses.

Module III: Vector Calculus

Scalar and vector field, Gradient, Divergence and Curl, Directional Derivative, Evaluation of a Line Integral, Green's theorem in plain (without proof), Stoke's theorem (without proof) and Gauss Divergence theorem (without proof)

Module IV: Probability and Statistics

Frequency Distribution, Arithmetic Mean, Median, Partition Values, Mode, Variance and Standard Deviation, Curve Fitting, Principle of least squares, Linear regression.

Introduction to Probability, Addition and Multiplication theorem of Probability, Random variables and Probability Distribution,Expected values, Binomial distribution, Poisson distribution and Normal.

Distribution and their Applications.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - II

Course Code: BTB 202 **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering.

Course Contents:

Module I: Wave Mechanics

de-Broglie matter waves, wave nature of particles, phase and group velocity, Heisenberg uncertainty principle, wave function and its physics interpretation, Operators, expectation values. Time dependent & time independent SchrÖdinger wave equation for free & bound states, square well potential (rigid wall), Concept of step potential.

Module II: Atomic Physics

Vector atom model, LS and j-j coupling, Zeeman effect & Paschen-Back effect, Bragg's law, X-ray spectra and energy level diagram, Laser – Einstein coefficient, population inversion, condition of light amplification, He-Ne and Ruby laser

Module III: Solid State Physics

Sommerfield's free electron theory of metals, Fermi energy, Energy bands in solids, physics of semi-conductors, doping, intrinsic and extrinsic semiconductors, Depletion layer, characteristics of PN junction, Forward and reverse baising, Breakdown voltage, Superconductivity, Meissner effect, Introduction to Nanomaterials

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Concept of Modern Physics, A. Beiser
- Applied Physics II, Agarawal & Goel
- Solid State Physics, S. O. Pallai
- Physics of Atom, Wehr & Richards

APPLIED CHEMISTRY - II

Course Code: BTB 203 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Water

Hardness of Water; Boiler Feed Water; Scale and Sludge; Softening of Water; External and Internal Treatment of Boiler Water; Domestic Water Treatment; Domestic Water Treatment; Desalination of Brackish Water; Chemical Analysis of Water; Dissolved O_2 (BOD, COD); Estimation of Free Chlorine; TDS.

Module II: Lubricants

Introduction; Mechanism of Lubrication; Types of Lubricants; Chemical structure related to Lubrication; Properties of lubricants; Viscosity and Viscosity Index; Iodine Value; Aniline Point; Emulsion number; Flash Point; Fire Point; Drop Point; Cloud Point; Pour Point. Selection of Lubricants.

Module III: Fuel

Introduction; Characteristics of good Fuel ; Calorific value; Bomb Calorimeter; Proximate and Ultimate analysis of coal; Carbonization of coal; Gasification and Liquification of coal: Fischer Tropsch and Bergius Process; Water Gas and Producer Gas

Module IV: Polymers

Introduction; Polymerization: Addition and Condensation Polymerization; Thermosetting and Thermoplastic Polymers; Molecular Weight of Polymer; Rubber, Plastic and Fiber; Preparation, Properties and uses of PMMA, Polyester, Epoxy Resins and Bakelite, Silicone Polymers.

Module V: Corrosion

Introduction, Mechanism of Dry and Wet Corrosion, Types of Corrosion, Galvanic Corrosion, Concentration Cell Corrosion, Passivity, Underground Soil Corrosion, Pitting Corrosion, Intergranular Corrosion, Waterline Influencing Corrosion, Corrosion Control.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Engineering Chemistry-Jain & Jain
- Engineering Chemistry- Shashi Chawla

References:

- Engineering Chemistry -Dara
- Engineering Chemistry -Sunita Ratan
- Polymer Science - Gowariker, Viswanathan Sreedhar
- Corrosion Engineering – Fontenna and Greene

OBJECT ORIENTED PROGRAMMING IN C++

Course Code: BTB 204 **Credit Units: 03**

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Course Contents:

Module I: Introduction
Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module II: Classes and Objects
Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module III: Inheritance
Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hiérarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module IV: Polymorphism
Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module V: Strings, Files and Exception Handling
Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997
- R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
- "Object Oriented Programming with C++" By E. Balagurusamy.
- Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.

References:

- Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
- Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
- Yashwant Kanethkar, "Object Oriented Programming using C++", BPB, 2004

ELECTRICAL SCIENCE

Course Code: BTB 205 **Credit Units: 02**

Course Objective:

The objective of the course is to provide a brief knowledge of Electrical Engineering to students of all disciplines. This Course includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of Transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Course Contents:

Module I: Basic Electrical Quantities

Basic Electrical definitions-Energy, Power, Charge, Current, Voltage, Electric Field Strength, Magnetic Flux Density, etc., Resistance, Inductance and Capacitance. Ideal Source, Independent Source and Controlled Source

Module II: Network Analysis Techniques & Theorems

Circuit Principles: Ohm's Law, Kirchoff's Current Law, Kirchoff's Voltage Law Network Reduction: Star–Delta Transformation, Source Transformation, Nodal Analysis, Loop analysis. Superposition theorem, Thevenin's Theorem, Norton's theorem and Reciprocity theorem.

Module III: Alternating Current Circuits

Peak, Average and RMS values for alternating currents, Power calculation: reactive power, active power, Complex power, power factor, impedance, reactance, conductance, susceptance Resonance: series Resonance, parallel resonance, basic definition of Q factor & Band-width.

Module IV: Transformers

Basic Transformer Operation principle, Construction, Voltage relations, current relations, Linear circuit models, open circuit test, short circuit test, Transformer Efficiency.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- R.J. Smith, R.C. Dorf: Circuits, devices and Systems
- B.L. Thareja: Electrical Technology : Part -1 & 2
- V.Deltoro: Electrical Engineering fundamentals
- Schaum's Series: Electrical Circuits

LIFE SCIENCES - II

Course Code: BTB 206 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. Moreover paper will provide knowledge of various physiological activities of higher plants which will help them to understand the various profiles of modern biotechnology.

Course Contents:

Module I: Anatomy & Physiology of Rabbit.

- Integumentary system
- Skeletal System: Girdles only
- Digestive system
- Respiratory System

Module II: Anatomy & Physiology of Rabbit.

- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Endocrine System
- Urinogenital System

Module-III Plant Physiology-I

Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration.

Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation; Plant Hormones.

Module-IV Plant Physiology-II

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

Respiration: Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
  Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.

APPLIED PHYSICS LAB - II

Course Code: BTB 220 **Credit Units: 01**

List of Experiments

12. To determine the wavelength of prominent lines of mercury spectrum using plane transmission grating.
13. To determine the thickness of a given wire by Wedge method.
14. To determine the wavelength of He-Ne laser light using single slit.
15. To determine the frequency of an electrically maintained tunning fork by Melde's method.
16. To study the variation of magnetic field along the axis of Helmholtz coil and to find out reduction factor.
17. To draw the V – I characteristics of a forward and reverse bias PN junction diode.
18. To determine the frequency of AC mains using sonometer.
19. To determine the energy band-gap of Germanium crystal using four probes method.
20. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
21. To determine the acceleration due to gravity ("g") using Keter's reversible pendulum.
22. To study the characteristics of photo voltaic cell (Solar cell).

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - II

Course Code: BTB 221 **Credit Units: 01**

Course Contents:

1. Determining the viscosity index of lubricating oil by using Redwood viscometer.
2. Determining the flash point and fire point of lubricating oil.
3. Determination of Hardness of Water.
4. Chemical Analysis of Water like Alkalinity, residual Chlorine.
5. Synthesis of Urea Formaldehyde resin.
6. Determination of Molecular weight of Polymer.
7. Determination of Ion exchange capacity of a region.
8. Determination of dissolved Oxygen in Water.
9. Determination of Iodine value in water.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

OBJECT ORIENTED PROGRAMMING IN C++ LAB

Course Code: BTB 222 **Credit Units: 01**

Software Required: Turbo C++

- Creation of objects in programs and solving problems through them.
- Different use of private, public member variables and functions and friend functions.
- Use of constructors and destructors.
- Operator overloading
- Use of inheritance in and accessing objects of different derived classes.
- Polymorphism and virtual functions (using pointers).
- File handling.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ELECTRICAL SCIENCE LAB

Course Code: BTB 223 **Credit Units: 01**

List of Experiments

11. To verify KVL & KCL in the given network.
12. To verify Superposition Theorem.
13. To verify Maximum Power Transfer Theorem.
14. To verify Reciprocity Theorem.
15. To determine and verify RTh, VTh , RN , IN in a given network.
16. To perform open circuit & short circuit test on a single-phase transformer.
17. To study transient response of a given RLC Circuit.
18. To perform regulation, ratio & polarity test on a single-phase transformer.
19. To measure power & power factor in a three phase circuit by two wattmeter method.
20. To measure power & power factor in a three phase load using three ammeters & three voltmeter method.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: BTB 241 **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication
Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation
Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills
Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills
Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays
Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya
Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

ENVIRONMENTAL STUDIES - II

Course Code: BTB 242 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

h. Air pollution
i. Water pollution
j. Soil pollution
k. Marine pollution
l. Noise pollution
m. Thermal pollution
n. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

INDIVIDUAL, SOCIETY AND NATION

Course Code: BTB 243 **Credit Units: 01**

Course Objective:

To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking
Thinking skills

Module II: Hindrances to Problem Solving Process
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation
Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

The six-phase model of Creative Thinking: ICEDIP model

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: BTB 244 **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

4. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
5. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
6. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

5. situer un lieu
6. s'orienter, s'informer sur un itinéraire.
7. Chercher, décrire un logement
8. connaître les rythmes de la vie

Unité 5 : s'informer

6. demander/donner des informations sur un emploi du temps passé.
7. donner une explication, exprimer le doute ou la certitude.
8. découvrir les relations entre les mots
9. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

CELL BIOLOGY

Course Code: BTB 301 **Credit Units: 03**

Course Objective:

Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. It incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The object of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Course Contents:

Module I
The cell theory, pre cellular evolution, prokaryotic and eukaryotic cells.

Module II
Cell cycle - molecular events, cell division, mitosis and meiosis.

Module III
Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus,lysosomes, peroxisomes, golgi bodies, and transport across membranes.

Module IV
Cell locomotion- cytoskeleton, structure and function of cilia and flagella.

Module V
Cellular signaling –general mechanism of signaling and structures of the various types of receptors.

Module VI
Types of cancer, etiology of cancer, metastasis, cytological role of p53 and p21 genes in cancer development.

Module VII
Apoptosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.

References:
- Cell in Development and Inheritance, E.B. Wilson, Macmilian
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.

BIOCHEMISTRY - I

Course Code: BTB 302 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Introduction aims and scope

Chemical foundations of Biology -Properties of water, acids, bases and buffers, covalent bonds, Non-covalent interactions in biological systems.

Module II

Introduction to biomolecules - *Carbohydrates* -Sugars; Polysaccharides

Lipids -classification, structure and function. Lipids and biological membranes, Lipid linked proteins and lipoproteins, Atherosclerosis.

Module III

Metabolism and bioenergetics -First and second law, free energy and chemical equilibrium, Organic reaction mechanisms, Design of metabolism-concept of free energy, ATP-ADP cycle. Cellular energy transactions -role of mitochondria and chloroplast

Module IV

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondrion and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module V

Lipid metabolism -Lipid digestion, absorption and transport, fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism. Cholesterol and Arachidonic Acid metabolism, Phospholipids, Sphingolipids and Glycolipids

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

MICROBIOLOGY

Course Code: BTB 303 **Credit Units: 04**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I

Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization,

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

MOLECULAR BIOLOGY

Course Code: BTB 304 **CreditUnits: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Course Contents:

Module I: DNA Replication and repair
Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication, DNA repair Mechanism.

Module II: Transcription
Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.

Module III: Modifications in RNA
5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

Module IV: Translation
Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.

Module V: Regulation of Gene Expression in prokaryotic and eukaryotic systems
Lac operon, Ara operan, regulation in Eukaryotes, Epigenetics.

Module VI: Antisense and Ribozyme technology
Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of Ribozyme; Hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense and ribozyme technologies.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing
- Gene VIII, Benjamin Lewin 2005, Oxford University Press

References:

- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.

DATA STRUCTURES THROUGH C++

Course Code: CSE 202 CreditUnits: 03

Course Objectives:

To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. To understand the notations used to analyze the Performance of algorithms. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations. To choose an appropriate data structure for a specified application. To understand and analyze various searching and sorting algorithms. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Course Contents:

Module I: Introduction to C++ (7 Hours)

C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers , friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism.

Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non Linear data structures.

Module II: Introduction to DS (6 Hours)

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular queues-Insertion and deletion operations.

Module III: TREES (6 Hours)

Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Minimum Spanning Tree: Prim's and Kruskal's Algorithm, Shortest Path Algorithms.

Module IV: SEARCHING & SORTING (5 Hours)

Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods.

Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.

Module V: GRAPHS(6 Hours)

Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis, Search Trees-Binary Search Tree ADT, Definition, Operations- Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees- Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.

Course Outcomes:

- Ability to choose appropriate data structures to represent data items in real world problems.
- Ability to analyze the time and space complexities of algorithms.
- Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Able to analyze and implement various kinds of searching and sorting techniques.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference:

- Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

CELL BIOLOGY LAB

Course Code: BTB 320 **Credit Units: 01**
Course Contents:

Module I
Microscopy: Light microscopy, Bright field, Phase contrast & Gram's staining.

Module II
Study of chromoplasts, chloroplast in plant cell.

Module III: Cell Division
Mitosis and Meiosis

Module IV
Study of permanent slides of types of cancer

Module V
Study of apoptosis

Examination Scheme:

IA			EE			
ClassTest (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

BIOCHEMISTRY LAB - I

Course Code:BTB 321 **Credit Units: 01**

Course Contents:

Module I
Colorimetric determination of pK.

Module II
Colour reactions of sugars. (Molischs test, iodine test, Saliwanoff test, Fehlings test, Benedicts test, Bials test).
Quantitative test for Carbohydrate & Protein.

Module III
Cholestrol estimation
Estimation of free fatty acids
Estimation of iodine number.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

MICROBIOLOGY LAB

Course Code: BTB 322 **Credit Units: 01**

Course Contents:

11. Preparation of solid and liquid media.
12. Isolation and maintenance of organisms by plating, streaking and serial dilution.
13. Preparation of slant cultures.
14. Growth curve measurement of bacterial population by turbidometry.
15. Measurement of bacterial population by dilution method.
16. Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.
17. Microscopic examination of bacteria by gram staining.
18. Endospore staining.
19. Capsule staining.
20. Isolation and identification of Rhizobium from root nodules.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MOLECULAR BIOLOGY LAB

Course Code: BTB 323 **Credit Units: 01**

Course Contents:

Module I
Preparation of DNA: genomic, Plasmid
Module II
Isolation of RNA
Module III
RFLP analysis
Module IV
Gel filtration
Module V
Preparation of Competent Cells
Module VI
Restriction Digestion and Ligation of DNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATA STRUCTURES THROUGH C++ LAB

Course Code: CSE 222 **CreditUnits: 01**

Total Hours : 20

Course Objectives:
To write and execute programs in C++ to solve problems using datastructures such as arrays, linked lists, stacks, queues, trees, graphs, hashtables and search trees.To write and execute write programs in C++ to implement various sortingand searching methods.

SOFTWARE REQUIREMENTS: Turbo C++ compiler or GCC compilers

List of experiments/demonstrations:

1. Write a C++ programs to implement recursive and nonrecursivei) Linear search ii) Binary search
2. Write a C++ programs to implement i) Bubble sort ii) Selectionsort iii) quick sort iv) insertion sort
3. Write a C++ programs to implement the following using an array.

a) Stack ADT b) Queue ADT

4. Write a C++ programs to implement list ADT to perform followingoperations
   a) Insert an element into a list.
   b) Delete an element from list
   c) Search for a key element in list
   d) count number of nodes in list

10. Write C++ programs to implement the following using a singly linked list. Stack ADT b) Queue ADT

6 Write C++ programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.

8. Write a C++ program to perform the following operations:

a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.

8 Write C++ programs for implementing the following sorting methods: Merge sort b) Heap sort

9.Write C++ programs that use recursive functions to traverse the given binary tree in a) Preorder b) in order and c) post order

10 Write a C++ program to perform the following operations
b) Insertion into a B-tree b) Deletion from a B-tree

Course Outcomes:

- Ability to identify the appropriate data structure for given problem.
- Graduate able to design and analyze the time and space complexity ofalgorithm or program.
- Ability to effectively use compilers includes library functions, debuggersand trouble shooting.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and.Mount, Wiley student edition, John Wiley and Sons.
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.***

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:

To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:
Toenablethe students
- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:
Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:
Exprimer l’obligationetl’interdiction,parler desqualitésetdesdéfautsdequelqu’un,demander son chemin, indiquerunitinéraire,se situerdansl’espace,serenseignersurunlogement.
Dossier6:AilleursActesdeCommunication:
S’exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l’insatisfaction.
Grammaire :
6. lesadjectifsdémonstratifs
7. lesverbes:‘irgroupe’devoir,falloir
8. lesprépositionsdelieu,depays
9. l’impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
10. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:
Le livre àsuivre:
- Andant,Christineet al.<u>A proposA1Livre del’élève</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.<u>A proposA1Cahierd’exercices</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:
- Girardeau,Brunoet NellyMous.<u>Réussirle DELFA</u>

TERM PAPER

Course Code: BTB 330 Credit Units: 02

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

7. Choosing a subject
8. Finding sources of materials
9. Collecting the notes
10. Outlining the paper
11. Writing the first draft
12. Editing & preparing the final paper

7. Choosing a Subject

The subject chosen should not be too general.

8. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

9. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

10. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

11. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

12. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure
It should be composed of the following sections:

11) Title page
12) Acknowledgement
13) Abstract
14) Table of contents
15) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
16) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
17) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
18) Results (If any)
19) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
20) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
d) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References
From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[3] Pandian, P.S.,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[4] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.
Appendix
The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.
Assessment Scheme:

Continuous Evaluation: (Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)	40%
Final Evaluation: (Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)	60%

BIOCHEMISTRY - II

Course Code: BTB 401 **Credit Units: 04**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Proteins -Amino acids and peptides - classification, chemical reactions and physical properties. Introduction to protein structure and function. Cis-trans peptide bond formation. Glycoproteins -structure and function, *Vitamins and Coenzymes*: structure and function of water soluble vitamins.

Enzymes -Introduction to kinetic and catalytic mechanisms of enzymes; Regulation of enzyme activity; Effects of physical parameters on enzyme activity, enzyme inhibitors – types of inhibition.

Module II

Nucleic acids - nitrogenous bases, nucleotides, types, structure and properties of nucleic acids

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, biosynthesis and breakdown of nutritionally non-essential amino acids (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine. Specialized Products of Amino Acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines, biosynthesis of nucleotide coenzymes (NAD, NADP, FAD, FMN; Catabolism of heam and clinical significance of bilirubin.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

GENETICS

Course Code: BTB 402 **Credit Units: 04**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.

Course Contents:

Module I

The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.

Module II: Mendelism

Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture.

Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.p

Module III

Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.

Module IV

Mutation and mutagenic agents, types of mutations, economic importance of mutation

Module V

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage

Module VI: Genetics of Population

Hardy- Weinburg Law and its deviations.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genetics, P.K. Gupta, Rastogi Publication
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

- Genetics, M.W. Strickberger, Prentice Hall College Division
- Genetics, P.J.Russell, Benjamin/Cummings
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.
- Genetics, R. Goodenough, International Thomson Publishing
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: BTB 403 **Credit Units: 03**

Course Objective:

The students will be exposed to techniques and instruments that are used in biotech industries.

Course Contents:

Module I: Electrophoresis

Agrose Gel electrophoresis, PAGE, SDS-PAGE, isoelectric focusing, two-dimensional electrophoresis, immuno electrophoresis, capillary electrophoresis

Module II: Chromatography

Paper, TLC, gel filtration, ion-exchange chromatography, affinity chromatography, HPLC and GLC

Module III: Spectroscopy

UV and visible spectroscopy ,Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Mass Spectrometry, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy,

Module IV

XI- ray diffraction and X-ray Crystallography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wi

CHEMICAL BIOLOGY

Course Code: BTB 404 **Credit Units: 03**

Course Objective:

Chemical biology is that branch of life science, which deals with the study and manipulation of biological systems through the application of chemical techniques and tools. It differs from the more traditional disciplines of chemistry and biology in its emphasis on integrating a wider series of experimental techniques, ranging from synthetic organic chemistry, to biochemistry, to structural, molecular, and cellular biology. Chemical biology has historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry and metabolic engineering.

Course Contents:

Module I: Principles of chemical biology
Chemistry of carbohydrates, proteins and nucleic acids, strategies for identifying the cellular target of physiologically active natural products (paclitaxel, vancomycin), chemical aspects of signal transduction

Module II: Chemical reactions in living systems
Introduction to enzyme chemistry, Group transfer reactions, Substitutions, Carboxylation and decarboxylation, Isomerases, Eliminations and additions, Redox reactions (1), Redox reactions (2), Aldol and Claisen Reactions, One-carbon transfer reactions, Rearrangements

Module III: Structural chemical biology
Purine biosynthesis, polyamide biosynthesis, thiamine biosynthesis, vitamin E biosynthesis, proteases

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Chemical Biology by H. Gobind Khorana
- Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH
- Foundations of Chemical Biology, C.M. Dobson, J.A. Gerrard, A.J. Pratt, Oxford Chemistry Primers
- Innovations in Chemical Biology, Sener Bilge, Springer
- Chemical biology by Stuart L. Shreiber, Tarun Kapoor, Gunther Wess, Wiley-VCH.

References:

- A General Method for Discovering Inhibitors of Protein−DNA Interactions Using Photonic Crystal Biosensors *Chem. Biol.*, 2008, *3* (7), pp 437–448.
- Optimization of non-natural nucleotides for selective incorporation opposite damaged DNA Org. Biomol. Chem., 2007, 5, 3623 – 3630.

DATABASE MANAGEMENT SYSTEMS

Course Code: CSE 304 **Credit Units: 03**

Course Objective:

The objective of this course is to get students familiar with Databases and their use. They can identify different types of available database model, concurrency techniques and new applications of the DBMS.

Course Contents:

Module I: Introduction (6 Hours)

Concept and goals of DBMS, Database Languages, Database Users, Database Abstraction.

Basic Concepts of ER Model, Relationship sets, Keys, Mapping, Design of ER Model, Concept of Generalization, Aggregation and Specialization. Transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model.

Module II: Relational Data models (6 Hours)

Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages:SQL-DDL, DML, integrity constraints, Complex queries, various joins, indexing, triggers,Relational algebra and relational calculus, Relational algebra operations like select, Project,Join, Division, outer union. Tuple relational calculus.

Module III: Data Base Design (6 Hours)

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies.

Module IV: Transaction Processing Concepts (6 Hours)

Transaction System, Testing of Serilizability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling.Concurrency Control Techniques: – Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction.

Module V: Relational Database Management Systems (6 Hours)

Study of Relational Database Management Systems through Oracle/Postgres SQL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi-threaded server, distributeddatabase. Introduction of ANSI SQL. Usage of like, any, all, exists, views and other commands, Special operators. Hierarchical queries, inline queries, flashback queries

Course Outcomes:

The student will learn

- Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
- Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
- Learn and apply structured query language (SQL) for database definition and database manipulation.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Korth, Silberschatz, "Database System Concepts", 4th Ed., TMH, 2000.
- Steve Bobrowski, "Oracle & Architecture", TMH, 2000

References:

- Date C. J., "An Introduction to Database Systems", 7th Ed., Narosa Publishing, 2004
- Elmsari and Navathe, "Fundamentals of Database Systems", 4th Ed., A. Wesley, 2004
- Ullman J. D., "Principles of Database Systems", 2nd Ed., Galgotia Publications, 1999.

BIOCHEMISTRY LAB - II

Course Code: BTB 420 **Credit Units: 01**

Course Contents:

Module I
Colour reactions of proteins (Ninhydrin test, Biuret test, Xanthoprotein test).
Estimation of proteins.
Module II
Biochemical estimation of DNA
Biochemical estimation of RNA
Quantitative determination of DNA and RNA by spectrophotometric method using UV range.
Determination of melting temperature of DNA from thermal denaturation characteristics.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS LAB

Course Code: BTB 421 **Credit Units: 01**

Course Contents:

1. Study of gene interaction.
2. Study of chromosomal translocation in Rhoeo discolor.
3. Study of bacterial conjugation.
4. Study of bacterial transduction.
5. Study of physical and chemical mutagens on growth of E. coli.
6. PTC test.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: **BTB 422** **Credit Units: 01**

Course Contents:

Module I
Cell disruption techniques

Module II
Centrifugation – low speed and high speed.

Module III
Spectrophotometer techniques

Module IV
Chromatography –Paper Chromatography and Thin Layer Chromatography

Module V
Electrophoresis –SDS Page and Agarose gel electrophoresis.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATABASE MANAGEMENT SYSTEMS LAB

Course Code: **CSE 324** **Credit Units: 01**

Software Required: Oracle 9i **Total Hours: 20**

Topics covered in lab will include the following Programs:

1. Using create command design three specific table and the table structure is given below.

Table name- Book

ISBN	TITLE	PUB_YEAR	UNIT_PRICE	AUTHOR_NAME	PUB_NAME
1001	Oracle	2004	399	Arora	phi
1002	Dbms	2004	400	Basu	technical
2001	Dos	2003	250	Sinha	nirali
2002	Adbms	2004	450	Basu	technical
2003	Unix	2000	300	Kapoor	scitech

Table name- Author

AUTHOR_NAME	COUNTRY
Arora	U.S.A
Kapoor	Canada
Basu	India
Sinha	India

Table name- Publisher

PUB_NAME	PUB_ADD1
Phi	Delhi
Technical	Pune mainmarket
Nirali	Mumbai
Scitech	Chennai

2. Write the SQL query to find the name of all publisher from Book relation.
3. Write the SQL query to display the name of all publisher using distinct clause.
4. Write the SQL query to find the names of author from the author table where the first two characters of names are 'ba'.
5. Write the SQL query to display title of books published in year 2004.
6. Write the SQL query to display title of books having price between 300 to 400.
7. Write the SQL query to display title of books having price between 300 to 400 using operators.
8. Write the SQL query to display title of books with author_name and country published in year 2004.
9. Write the SQL query to display all title and (unit_price*10) as an attribute from book table using arithmetic expression.
10. Write the SQL query to add the new column in all three tables.
11. Study the concept of Views and their utility in DBMS ,write the SQL query to design a view.
12. Write the SQL query to make the attribute ISBN as a primary key in Book relation.
13. Write the SQL query to display the all the titles of Books with price and year in descending order.
14. Write the SQL query to study the use of Delete and Drop command in DBMS.
15. Study the concept of Triggers, cursors and Stored procedures in DBMS.

Course Outcome:

- At the end of lab session students would be able to design the Database application for the real life projects.
- Students would be able to perform insertion, deletion and updation operation on Databases.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***

Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010. Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.***

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics
&values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage,
commitment Professional Values-Work ethics,
respect for others
Its role in personality development Character building- New-self awarness

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.
Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’ exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

4. l’imparfait,
5. lacomparaisonduverbe/dunom ; mieux/meilleur
6. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:

Text:

Le livre àsuivre:

Andant,Christineetal.<u>A proposA1Livre del’élève</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Andant,Christineetal.<u>A proposA1Cahierd’exercices</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,Brunoet NellyMous.<u>RéussirleDELFA1.</u>Paris: Didi

PLANT BIOTECHNOLOGY

Course Code: BTB 501 **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I

Historical perspective of plant tissue culture.
Tissue culture lab and organization
Sterilisation techniques
Types of nutrient media and media composition
Plant regeneration pathways
Role of phytohormones
Cell culture techniques- cell, tissue, organ cultures, callus culture, suspension culture
Culture techniques Callus culture, cell culture and protoplast cultures.

Module II

Organogenesis and somatic embryogenesis.
Applications of plant tissue and cell culture.
Micropopogation, pathogen free plants. production haploids,
Somaclonal variation.preservation of germplasm.

Module III

Genetic engineering in plants, - transformation vectors
Gene transfer techniques-vector meditated and vector less gene transfer.
Transgenic plants Tran's gene integration and expression

Module IV

Transgenic crop with new traits-herbicide tolerance, insect and disease resistance,
Therapeutic proteins and compounds
Oral vaccines
Production of secondary metabolites via tissue culture
Bioethics of plant genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: BTB 502 **Credit Units: 03**

Course Objective:

The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I
Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering.

Module II
Cell culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures

Module III
In vitro fertilization and embryo transfer

Module IV
Somatic cell hybridization, hybridoma technology

Module V
Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer

Module VI
Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc.

Module VII
Bioethical issues related to animal biotechnology,

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

STRUCTURAL BIOLOGY

Course Code: BTB 503 **Credit Units: 03**

Course Objective:
The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

Course Contents:
Module I: Chemistry of amino acids and peptides
Side chain structure and function in protein folding and functionality: Secondary structure of proteins -helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Structure and function of an antibody; structure of hemoglobin, muscle proteins; Sequence and structural motifs in proteins.

Module II: Protein-ligand interactions
Lock and key versus handshake mechanism of substrate recognition; structural basis of recognition; reaction mechanisms of enzymes, G-Protein coupled receptors.

Module III: Protein solubility, protein stability and stabilization
Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding

Module IV: DNA structure
Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules -Rasmol, Deepview, Whatif.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Biochemistry, R.H. Abeles, P.A. Frey and W.A. Jencks, Jones and Bartlett.
- Essentials of Molecular Biology, D. Freifelder, Jones and Bartlett Publications.
- Genes VII, B. Lewin, Oxford University Press.

References:
- Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company.
- Protein Structure, M. Perutz, Oxford University Press.
- Proteins (Structures and Molecular Properties), T.E. Creighton, W.H. Freeman and Company.
- Database Annotation in Molecular Biology, Arthur M. Lesk.
- From Genes to Clones, E.L. Winnacker.
- Genes & Genomes, M.S. Paul Berg.
- Structure and Machanism in Protein Science, Alan Fersht.

CHEMICAL ENGINEERING PRINCIPLES

Course Code: BTB 504 **Credit Units: 03**

Course Objective:

The knowledge gained through chemical reaction engineering and material and energy balances will help the students to understand the tools and techniques of biotechnology.

Course Contents:

Module I: Material and Energy Balances

Units and dimensions, Dimensional analysis; Simple problems on material balance calculations involving unit processes and reactive systems; Available electron balances.

Basic energy concepts -enthalpy changes in chemical/biochemical reactions and in non-reactive processes, Energy balance calculations, Use of Steam tables; Heat of reaction and energy balance for microbial processes.

Module II: Chemical reaction engineering

Kinetics of homogenous reactions: Concepts of reaction rate, order of reaction and molecularity, Analysis of batch reactors for kinetic interpretation of data and isothermal reactor design for single and multiple reactions, Design equations for CSTR and plug flow reactors.

Module III: Instrumentation and process control

Principles of measurement: error, accuracy and sensitivity; Measurement of flow, pressure, temperature, level, pH, viscosity and chemical composition.

Basic concepts of feedback control, control loop and its elements, Dynamic behaviour of first, second and higher order physical systems, controller hardware, choice of controllers and settings. Introduction to advanced control systems: feed forward, cascade and ratio control.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, Prentice Hall
- Basic Principles of Chemical Engineering, E.I. Shaheen, Houghton Mifflin

References:

- Chemical Process Control, An introduction to Theory and Practice, G. Stephanopoulos, Prentice Hall Inc.
- Chemical Reaction Engineering, O. Levenspiel, John Wiley and Sons Inc.
- Elementary Principles of Chemical Processes, R.M. Felder and R.W. Rousseau, John Wiley and Sons Inc.
- Fundamentals of Chemical Reaction Engineering, C.D. Holland and R.G. Anthony, Prentice Hall Inc.
- Process Modelling, Simulation and Control for Chemical Engineers, W.L. Luyben, McGraw Hill

BASIC BIOANALYTICAL TECHNIQUES

Course Code: BTB 505 **CreditUnits: 03**

Course Objective:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

Course Contents:

Module I: Solution and Buffers
Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.

Module II: Centrifugation
Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation.

Module III:Microscopy
Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy.
Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

Module IV: Radioisotope techniques
Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio – immunoassay.

Module V
Cell Disruption techniques, ultra filtration, dialysis and reverse osmosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

JAVA PROGRAMMING

Course Code: CSE 403 **CreditUnits: 3**
Total Hrs: 30

Course Objective:

The objective is to impart programming skills used in this object oriented language java.The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I(7 Hours)

Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison.Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays

Module II(7 Hours)

Classes and Objects in Java: Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces.Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages.

Module III(6 Hours)

Multithreaded Programming:Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication.Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.

Module IV(7 Hours)

GUI Programming -Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers, Swing Packages, Exploring Swing components ,Generating Swing Application

Module V(3 Hours)

Event Handling -The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**ESE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH
- Introduction to JAVA Programming a primar, Balaguruswamy.

References:

- “Introduction to JAVA Programming” Daniel/Young PHI
- Jeff Frentzen and Sobotka, “Java Script” , Tata McGraw Hill,1999

Course Outcomes:

The student will learn

- Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- Students can demonstrate ability to implement multithreading in the programming.
- To learn syntax and features of exception handling
- Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings.
- To demonstrate the ability to handle Events in the Programming

PLANT BIOTECHNOLOGY LAB

Course Code: BTB 520 **Credit Units: 01**

Course Contents:

Module I
Sterilization of glasswares and equipments.
Preparation of cotton plugs and culture media
Preparation of stocks for culture media
Preparation of culture media

Module II
Preparation and sterilization of different explants
Inoculation of explants on culture media

Module III
Study of viability of seeds
Embryo culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL BIOTECHNOLOGY LAB

Course Code: BTB 521 **CreditUnits: 01**

Course Contents:

5. Preparation, standardization and sterilization of culture media
6. Inoculation of specific tissues for callusing
7. Inoculation and maintenance of cell lines
8. Study of toxicity on cell lines

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

STRUCTURAL BIOLOGY LAB

Course Code: BTB 522 **Credit Units: 01**

Course Contents:

7. Study of physical properties of proteins.
8. Analysis of protein structure.
9. Study of protein finger printing
10. Study of protein fractionation
11. Study of protein folding
12. Study of protein degadation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

JAVA PROGRAMMING LAB

Course Code: CSE 423 Credit Units: 2

Course Objective:

Programming in the Java programming language, knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

3. Lab assignment will be based on the following: (40 Hours)

1. Use Eclipse or NetBeans platform and acquaint with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop. :**(2 Hours)**
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero. :**(2 Hours)**
3. Develop an applet in Java that displays a simple message. :**(1 Hours)**
4. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked. :**(1 Hours)**
5. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 andNum2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box. :**(2 Hours)**
6. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. :**(2 Hours)**
7. Write a Java program that connects to a database using JDBC and does add, delete, modify and retrieve operations. :**(1 Hours)**
8. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially there is no message shown. :**(1 Hours)**
9. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape. : **(1 Hours)**
10. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout. :**(2 Hours)**
11. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes). :**(1 Hours)**
12. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab. It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables). :**(1 Hours)**
13. Implement the above program with database instead of a text file. :**(1 Hours)**
14. Write a Java program that takes tab separated data (one record per line) from a text file and inserts them into a database. :**(1 Hours)**
15. Write a java program that prints the meta-data of a given table. :**(1 Hours)**

2 Students are required to develop anJAVA based application or model as project.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

- Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

Text:

- Java Fundamentals - A comprehensive Introduction, HerbetSchidt and Dale Srien, TMH.

References:

- Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI.
- Object Orientd Programming through Java, P. Radha Krishna, Universities Press.
- Thinking in Java, Bruce Eckel, Pearson Education
- Programming in Java, Bruce Eckel, Pearson Education
- Programming in Java, S. Malhotra and S. Choudhary, Oxford Univ. Press.

Course Outcome:

- knowledge of the structure and model of the Java programming language, (knowledge)
- use the Java programming language for various programming technologies (understanding)
- develop software in the Java programming language, (application)
- evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
- propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary**	**35% Weightage**
	• Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	
2.	**Module II Comprehension Skills**	**25% Weightage**
	• Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:** (see below)	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensemble
ActesdeCommunication:
Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,
l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision
Exercicesd'écoute,productionorale et écrite.

Grammaire :

5. le présent (révision),lepassé composé(révision)
6. lespronomscomplémentsdirects,lespronomscompléments indirects
7. lesmarqueurschronologiques
8. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

SUMMER PROJECT - I

Course Code: BTB 560 **Credit Units: 05**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

4. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

4.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

4.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

4.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

4.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

4.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

4.6 **Abstract** and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

4.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

4.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

4.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

4.10 List of Acronyms and Standards

4.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

4.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

4.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

5. Production of Project Report

5.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

5.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

5.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

5.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

5.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

6. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

6.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

6.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

6.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

6.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.4 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.4.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.4 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

RECOMBINANT DNA TECHNOLOGY

Course Code: BTB 601 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I: Enzymes used in RDT

Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.

Module II: Cloning vectors

Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering

Module III: Blotting techniques and hybridization

Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.

Module IV: Nucleic acid amplification and its applications

Principles of PCR, designing of primers

Module V: Cloning Techniques

Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure , Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immunoscreening.

Module VI: DNA Libraries

Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries.

Module VII: Sequencing of DNA

DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor
- Laboratory Press.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: BTB 602 **Credit Units: 03**

Course Objective:
The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Michaelis Menten equation, Linear plots, King-Altman's method; Inhibitors and activators; Multisubstrate systems; ping-pong mechanism, Alberty equation, Sigmoidal kinetics and Allosteric enzymes

Module III
Immobilization of Enzymes; Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects.

Module IV: Enzyme reactors
Reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems, Mass transfer in enzyme reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reaction.

Module V: Bioprocess Design
Physical parameters, reactor operational stability, Immobilized cells.

Module VI: Challenges and future trends
Enzyme catalysis in organic media; catalytic antibodies and non protein biomolecules as catalysts, biocatalysts from extreme thermophilic and hyper thermophilic Archae and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.

References:
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner.
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience.
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: BTB 603 **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I: Introduction
Phylogeny of Immune System, Innate and acquired immunity, clonal nature of Immune Response.
Organization and structure of lymphoid organs Nature and Biology of antigens and super antigens Antibody structure and function; Types of immunity- innate, acquired, active and passive.
Module II: Major Histocompatibilty
MHC, BCR and TCR, generation of antibody diversity, Complement system
Module III: Cells of the immune system
Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T -Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells
Module IV: Regulation of immune response
Antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance
Module V: Cell mediated toxicity
Mechanism of T cell and NK cell mediated lysis and macrophage mediated cytotoxicity.
Module VI: Hypersensitivity
Module VII: Autoimmunity
Module VIII: Tumor immunology, Immunity to infectious agents
Module IX: Transplantation Immunology

Module X: Synthetic vaccines
Vaccines: General consideration, ideotype network hypothesis, Synthetic vaccines

Module XI: Hnmunological Techniques
Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter

Module XII: Hybridoma technology and its applications
Fusion of myeloma cells with lymphocytes

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

COMPUTATIONAL BIOLOGY

Course Code: BTB 604 **Credit Units: 03**

Course Objective:
The objective is to describe relational data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures genetic mapping etc.

Course Contents:
Module I: Introduction and overview
The NCBI data model; sequence databases, sequence retrieval, sequence file formats, submitting DNA and protein sequences.
Types of biological databases, Databases and rapid sequence analysis
Module II: Sequence alignment
Global and local alignments, statistical significance of alignments, scoring matrices and gap penalties, filtering, position specific scoring matrices, internet resources, Pairwise and multiple alignment, uses of pairwise and multiple sequence alignment, programs and methods for sequence alignment, pattern searching programs, family and superfamily representation, structural inference, dynamic programming algorithms, alignment by hidden Markov models, consensus word analysis, more complex scoring.
Module III: Phylogenetic prediction
Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.
Module IV: Predictive methods using DNA and protein sequences
ESTs – databases, clustering, gene discovery and identification, and functional classification.
Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification;
Module V
Molecular modeling – PDB and MMDB, structure file formats, visualizing structural information, advance structure modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Molecular mechanics and dynamics, Docking of Molecules, Knowledge base structure prediction, Molecular Design, structure similarity searching; Secondary structure prediction in proteins, prediction of buried residues in proteins;

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

References:
- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F Quellette, Wiley – interscience.
- Bioinforamtics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. Von Heijne and G. Von Heijne, Academic Press.

FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Course Code: BTB 605 **Credit Units: 03**

Course Objective:

The course material on the kinetics of microbial growth, substrate utilization and product formation etc. may help the students to understand the various principles involved in instrumentation and control of bioprocess.

Learning outcome:

After successful completion of the course student will be able to:

- Learn the different phases of microbial growth, kinetics of substrate utilization and product formation.
- Understand various sterilization techniques and its principles.
- Familiarize themselves with the different parts, function and types of bioreactors and valves.
- Understand the mass transfer phenomenon, principles involved in instrumentation and control of bioprocess.

Course Contents:

Module I

Kinetics of microbial growth, substrate utilization and product formation.

Module II

Sterilization of air and medium.

Module III

Batch, continuous ,cell recycle and fed batch reactors; mass and energy balance in microbial processes, Bioreactor design, Different types of bioreactors, their parts and functions. Different types of valves.

Module IV

Mass transfer in Biological reactions; Scale-up principles; Instrumentation and control of bioprocesses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Biochemical Engineering Fundamentals, J E Baily and D F Oillis, McGraw Hill
- Bioprocess Engineering Principles, P Doran, Academic Press

References:

- Chemical Engineering, J M Coulson, and J F Richardson, Butterwirth Heinemann
- Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, HC Vogel, CL Todaro, CC Todaro, Noyes Data Corporation/Noyes Publications
- Process Engineering in Biotechnology, A T Jackson, Prentice Hall

RECOMBINANT DNA TECHNOLOGY LAB

Course Code: BTB 620 **Credit Units: 01**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

Module I

Study of cloning (GFP CLONING)

Module II

Study of PCR

Module III

Study of Southern hybridiosation

Module IV

Study of RAPD

Module V

Site directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code:BTB 621 **CreditUnits: 01**

Course Objective:

The laboratory will help the students to isolate enzymes from different sources, enzyme assays and studying their kinetic parameters which have immense importance in industrial processes.

Course Contents:

Module I

Isolation of enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulase, protease.

Module III

Purification of Enzyme by ammonium sulphate fractionation.

Module IV

Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity, determination of Michaelis-Menten constant (K_m) and Maximum Velocity ($V_{max.}$) using Lineweaver-Burk plot.

Module V

Effect of Temperature and pH on enzyme activity.

Module VI

Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: BTB 622 **CreditUnits: 01**

Course Contents:

Module I
Blood film preparation and identification of cells.
Module II
Identification of blood group.
Module III
Isolation of serum.
Module IV
Lymphoid organs and their microscopic organization.
Module V
WIDAL Test
Module VI
Radial Immuno Diffusion Test
Module VII
Ouchterlony Double diffusion Test
Module VIII: Elisa
DOT, SANDWICH
Module IX
Purification of lgG through affinity chromatography
Module X
Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

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COMPUTATIONAL BIOLOGY LAB

Course Code: BTB 623 **CreditUnits: 01**

Course Contents:

List of Experiments/Exercises.

10. Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
11. Local and Global Alignment- concepts Pair wise sequence alignment
12. Multiple sequence alignment
13. Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
14. Motif and pattern searching
15. Phylogentic prediction and analysis
16. Structure predicition
17. Finding transcription regulatory signals
18. Docking

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology).*Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
iv)express their sentiments, emotions and opinions, reacting to information, situations;
v) narrate incidents, events;
vi) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

7. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser

4. Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

BIOPROCESS TECHNOLOGY

Course Code: BTB 701 **Credit Units: 03**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process

Module II

Process technology for the production of primary metabolites, eg. Biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides

Module III

Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture

Penicillin: Classification, various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc.

Streptomycin: chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc.

Tetracycline: chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.

Module IV

Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Bioprocess Engineering Principles, P Doran, Academic Press
- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press
- Process Engineering in Biotechnolgy, A T Jackson , Prentice Hall

DOWNSTREAM PROCESSING

Course Code: BTB 702 **Credit Units: 03**

Course Objective:

The syllabus will help the students to characterize the Bioproducts due to downstreaming process of biotechnological importance.

Course Contents:

Module I
Characteristics of Bioproducts; Coagulation, Flocculation and conditioning of broth.

Module II
Mechanical separation; Cell disruption techniques

Module III
Protein precipitation and separation

Module IV
Aqueous- two- phase extraction, Adsorption-desorption processes

Module V
Chromatographic methods of separation based on size, charge, hydrophobic interactions and biological affinity

Module VI
Membrane based separation; Dialysis, Electrodialysis; Micro filtration, Ultra filtration; Electrophoresis

Module VII
Crystallization; Drying

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill.
- Bioseparatioins, P.A. Belter, E.L. Cussler and W.S. Hu, John Wiley and Sons Inc.Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering / Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society.
- Protein Purification, M.R. Ladisch, R.C. Willson, C.C. Painton and S.E. Builder, American Chemical Society.

STATISTICS FOR BIOLOGY

Course Code: BTB 703 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice.

Course Contents:

Module I

Statistics and Biostatistics: Preliminary concepts.
Measures of Central Tendency: Mean, Median, Mode
Measures of Dispersion: Range, Standard deviation, Variance

Module II

Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.

Module III: Continuous Distribution

Normal Distribution, Properties of Normal distribution

Module IV: Correlation

Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, some examples.

Module V: Regression

Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples.
Method of least square: Fitting of straight line

Module VI: Introduction to the following Statistical terms

Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications.
Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test.
Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means.
Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity.
Analysis of Variance: One way and two way (only Examples)

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
- Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
- Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand & Co.

References:

- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons
- Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
- Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

BIOSENSORS

Course Code: BTB 704 **Credit Units: 03**

Course Objective:

The course aims at developing an understanding of Biosensor technology needed critically for the development of small, sensitive, and selective biosensor devices and detection systems that can reliably operate in real time and in extreme and diverse physical environments. Biosensors are important tools in food safety diagnostics, medical monitors, and detection systems for biological warfare agents.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and trnsducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Affinity Biosensors: Techniques and Protocols, K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applicatrions, V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors, B.R. Eggins, John Wiley and Sons Inc.
- Sensors and Sensing in Biology and Engineering, F.G. Barth, wt al, Springer Verlag.

THERMODYNAMICS OF BIOLOGICAL SYSTEMS

Course Code: BTB 705 **Credit Units: 03**

Course Objective:

The main aim is to understand the basis of theories related to combustion and dissolution. It will help in the study of heat evolution, control of dissipation and will suggest ways for solving the rate phenomena through the dynamics of mass transfer applicable to biological process

Course Contents:

Module I
Energy, thermodynamics and living processes - an introduction

Module II
Energetic processes in the biosphere: The ecosystem.

Module III
Thermodynamics systems: equilibrium, activity coefficients and phase equilibrium functions of state, cyclic processes, work, energy and metabolic heat; Mechanical equivalent of heat, energy as a function of state.

Module IV: The laws of thermodynamics
Second law; Reversible vs. irreversible processes entropy, work; Combination of the first and second law, Free energy, useful work and delta G. Entropy: Ideality and Molecular Cohesion, Probabilistic nature of Entropy, Order and Disorder.

Module V: Biological systems as open, non-equilibrium systems
Failure of classical thermodynamics in describing biological processes, Standard free energy changes and equilibrium constants, direction and rate.

Module VI: Chemical potential
Visualization of the potential velocity and steady flow; Fick's law and diffusion. Local Equilibria and steady state: Energy vs. Power; Transducers in biological states, Constitutive equations, Dynamic efficiency and Onsager (nonequilibrium thermodynamics), Prigogine's principle, Spontaneous coupling and entropy production.

Module VII: Non-equilibrium thermodynamics
Reversible work, exact differentials and function of state, first and second law, The electrochemical potential, External forces an steady state, Fick's Law, chemical reactions in the steady state, internal entropy production, cells as non-equilibrium stationary states; Diffusion and membrane transport. Thermodynamic analysis of oxidative photophospghorylation, stability of non-equilibrium stationary states, ordering in time and space far from equilibrium, glycolytic oscillations, biological clocks, routes to chaos.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Bioenergetics, A.L. Lehninger, W.A. Benjamin Inc.
- Biological Thermodynamics, D.T. Haynie, Cambridge University Press.
- Biophysical Chemistry, C.R. Cantor and P.R. Schimmel, Freeman
- Physical Chemistry: Principles and Applications in Biological Sciences, I. Tincoco, K.Sauer and J.C. Wang, Prentice Hall College Division.
- Physical Chemistry for the Chemical and Biological Sciences, R. Chang, University Science Books
- Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, John Wiley and Sons Inc.

PHARMACEUTICAL CHEMISTRY AND DRUG DESIGN

Course Code: BTB 706 **Credit Units: 03**

Course Objective:

The main objective of this course is to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. The contents will introduce them to various drug molecules used in treatment, mitigation and cure of different disease. The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I

Introduction of pharmaceutical Chemistry, Overview of drug discovery process.

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action

Module II: Drug Targets and their validation

Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins

Validation Strategies

Module III: Drug Design Strategies

A. Structure-based design-Docking and denovo methods

B.Design and development of combinatorial libraries for new lead generation

The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemiometrics in drug design.

C. QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.

Module IV

Drug toxicity, tolerance, dependence, addiction, Dose Response curves

Module V

Survey of various Drug Classes – Anaesthetics (general, local), Analgescis, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids- Mechanism of action and applications

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press
- Pharmaceutical Dosage forms and Drug Delivery Systems, H.C. Ansel , L.V. Allen, N.G. Popovich, Lippincott Williams and Wilkins Publishers
- Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry, T.L. Lemke, Lea and Febiger

CURRENT TOPICS IN BIOTECHNOLOGY

Course Code: **BTB 707** **Credit Units: 03**

Course Objective:

A complete understanding of the application of biotechnology in various fields can be understood by studying the various modules of this paper. Success of biotechnology depends largely on how it can be effectively utilized in finding solutions to many vexed problems of present day society. The objective of this paper is to familiarize the students with some of the frontier areas if biotechnological applications where a huge scope for further contributions for betterment of the society exists. The paper shall be a interface between the students and the social at large.

Course Contents:

Module I: Bioremediation

Introductory concept, Bioremediation principles, mechanism for Bioremediation of air, water and soil pollutants, bioremediation examples, commercial application of bioremediation techniques, recombinant DNA technology and bioremediation, bioremediation models, bioremediation software

Module II: Genetically modified organisms

Genetically modified food crops, food animals – examples and mode of production, future goals in GM food crops and animals, scientific evaluation of public concerns, legal requirements in production of GMO, current trends and consumer acceptance.

Module III: Molecular medicine

Gene mutation, point mutation, allele specific oligonucleotides, ARMS, oligonucleotide ligation, disease diagnosis with linked genetic markers, fluorescently labeled DNA sequencing.

Module IV: Nano-biotechnology

Introduction, definition, hybrid nanopracticles, smrat drug delivery, gene sensors, biomolecule control, nanofluids, nanotechnology in medicine.

Module V: Stem cells

Definition, properties, proliferation, culture of stem cells, medical applications of stem cells, ethical and legal issues in use of stem cells.

Module VI: Cancer Biology

Types of cancer, development, causes and properties of cancer, viruses (Hepatitis B & C, SV4U, polymo marines, pupillomarines, adenosines, retrovineses); retroviral oncogenes, proto-oncogenes, turmor suppressor genes, recent advances in detection and treatment of cancer.

Module VII: Forensic Biotechnology

MLP, SLP technology, PCR technology in crime detection, STR and databases, mitochondrial DNA and Y chromosome analysis in forensic science, DNA chip technology, role of molecular biology and biotechnology in crime detection.

Module VIII: Bio sensor

Biological reaction, amperometric biosensor, potentiometric biosensor, conductimetric bioseosors, calorimetric biosensor, piezoelectric biosensor, whole-cell biosensor, immunosensors.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- The Cell – A molecular Approach, 3rd Edn, Geoffrey M. Cooper and Robert E. Hausman, ASM Press
- Molecular Biology and Biotechnology, 4th Edn, J.M Walker and R. Rapley, Panima Books
- Cell Biology, David. E. Sadava, Panima Books
- Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press
- Environmental Microbiology, 2nd Edition, Ian L.Pepper and Charles P. Gerba, Elsevier Pub.
- Environmental Biotechnology – Concepts and Application, Hans – Joachim Jordening and Jesefwinter – Wiley – VCH

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BTB 708 **Credit Units: 03**

Course Objective:

Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents:

Module I: Introduction
Ecology and ecosystem.

Module II: Environmental pollution
Water, soil and air, noise and thermal pollution, their sources and effects.

Module III:Waste water (sewage and industrial effluents) treatments
Anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria- technical process and conditions, emerging biotechnological processes in waste - water treatment.

Module IV: Solid waste management
Landfills, composting, earthworm treatment, recycling and processing of organic residues**.**

Module V:Biodegradation
Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution

Module VI: Microbial leaching and mining
Microbial leaching and mining: Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Module VII:Wasteland
Wasteland: Uses and management, bioremediation and biorestoration of contaminated lands.

Module VIII:Environmental genetics
Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.

Module IX: Hazardous wastes
Hazardous wastes: source management and safety.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Biotechnology by PK Mohapatra

References:

- Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
- BiotreatmentSystems, Vol.22, D. L. Wise (Ed.), CRCPress, INC.
- Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association.

BIOPROCESS PLANT DESIGN

Course Code: BTB 709 **Credit Units: 03**

Course Objective:

The objective of this paper is to include not only the application of chemical engineering principles/unit operations to bioprocess systems but also to include the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I

Introduction; general design information; Mass and energy balance; Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Applied Process Design for Chemical and Petrochemical Plants, E.E. Ludwig, Butterworth-Heinemann
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann
- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling, F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design, E. Bausbacher and R. Hunt, Prentice Hall PTR.

ARTIFICIAL NEURAL NETWORKS

Course Code: BTB 710 **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, beides the closely related aspects of artificial neural networks.

Course Contents:

Module I

Historical background, Why is learning hard?

Module II

Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multi-layer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning,

Module III

The backpropagation algorithm, Aspects of Learning Theory and Generlization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?

Module IV

Neural networks and analog VLSI, Selected Applications

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Neural Networks: A Comprehensive Foundation, S. Haykin, Prentice Hall
- Neutral Networks for Pattern Recognition, C. Bishop, Oxford University Press

ADVANCED JAVA PROGRAMMING

Course Code: CSE 504 **CreditUnits: 03**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Course Contents:

Module I (5 Hours)

Introduction to Java RMI, RMI services, RMI client, Running client and server, Introduction of swing, swing components, Introduction to Multimedia Programming

Module II (5 Hours)

Database Connectivity using JDBC- Understanding JDBC, Define the layers in JDBC architecture, various types of JDBC drivers, manipulating various SQL Queries, Manage transactions and perform batch updates in JDBC, Creating Database Connectivity Applications, Connection to Database with the java.sql Package.

Module III (8 Hours)

Introduction to sever side programming, Introduction to Servlets, Web Container, Servlet Life Cycle, and Servlet based Applications, Servlet and HTML. Web.xml file. Session tracking

Module IV (6 Hours)

JSP: Introduction to JSP, JSP architecture, JSP syntax Basics, JSP implicit objects, JSP based Applications. The Model-View-Controller Architecture. Session management.

Module V (6 Hours)

Enterprise Java Beans:-EJB roles—EJB Client-Object -container-Transaction Management—implementing a Basic EJB Object-Implementing session Beans-Implementing Entity Beans-Deploying an enterprise Java Beans Object-Changes in EJB1.1 specification.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
- Professional Java Server Programming (a Press) By Allamaraju
- Developing Java Servlets (Techmedia – SAMS) By James Goodwill
- Using Java 1.2 Special Edition (PHI) By Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, “JAVA 2” PEARSON publication

Course Outcomes:

The student will learn

- Can develop Java Applets, Beans programming.
- Can Understand Advanced Java Networking concepts and develop server side application.
- Can learn Server Side Programming Concepts and create Dynamic web Application.
- Know about the JDBC Principles and can interact with back end database with java programming.
- Understand the application server and also understand the enterprise level applications.

BIOPROCESS TECHNOLOGY LAB

Course Code: BTB 720 **Credit Units: 01**

Course Contents:

Module I
Isolation of industrially important micro organisms for microbial processes.
Module II
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Module III
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.
Module IV
Comparative studies of ethanol production using different substrates.
Module V
Production of single cell protein
Module VI
Production and estimation of alkaline protease
Module VII
Sauer Krant fermentation
Module VIII
Use of alginate for cell immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

DOWNSTREAM PROCESSING LAB

Course Code: BTB 721 **Credit Units: 01**

Course Objective:

The laboratory will help the students to extract different bioproducts during their characterization since any of these products may be of biotechnological importance. They can be exploited in exploring the future biotechnology.

Course Contents:

Module I
Conventional filtration and membrane based filtration
Module II
Protein precipitation and recovery
Module III
Aqueous two-phase separation
Module IV
Ion exchange chromatography
Module V
Gel Permeation chromatography
Module VI
Electrophoresis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

ADVANCED JAVA PROGRAMMING LAB

Course Code: CSE 524 **CreditUnits: 1**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Programming Language: Java

12. Implement two services that should be run on a given network host. You should use JavaRMI. Develop a basic arithmetic calculator with the help of java RMI.
13. Write a Java program that can create an employee form for inserting the detail of employee in an organization by using Applets create a JFrame which have labels, text box, Radio button, Check Box, button etc.
14. For the above form write a programme to handle the events for checking the data input by user.
15. WAP that implement a JApplet and display the following frame
    a. Customer name
    b. Customer number
    c. Age
    d. Address
16. Write a Java program to access a table Employees for Oracle Sample database in HR Schema using Java code.
17. Write a Java program to manipulate a table Employees for Oracle Sample database in HR Schema using Java code.
18. Write a Java program that implement a simple servlet program.
19. Write a Java program for authentication,
    d). Create the Web Page for User-Name and Password
    e). Validate the login-id and password by the servlet code.
    f). Connecting a database using user-id and password.
20. Write a Java program to product selling web site
    c) Read data send by the client (HTML page)
    d) Insert data into the database using the prepared statement.
    c). Display the output to client for item purchased or not.
21. Write a Java program to include a HTML page into a JSP page to product purchasing.
    d) Read data send by the client (HTML page)
    e) Insert data into the database using the prepared statement.
    c). Display the output to client for item purchased or not.
22. Write a Java program using Enterprise Java Beans for creating an application
    f) Adding a Session EJB component to handle the business logic of the J2EE Application.
    g) Integrating the DAO into the Session EJB.
    h) Adding an Entity EJB
    i) Integrating the Entity EJB into the Session EJB.
    j) Interfacing the Web Tier with the Session EJB.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
- Professional Java Server Programming (a Press) By Allamaraju
- Developing Java Servlets (Techmedia – SAMS) By James Goodwill
- Using Java 1.2 Special Edition (PHI) By Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, "JAVA 2" PEARSON publication

Course Outcomes:

- Ability to design and develop Java Applets, Beans programming.
- Ability to design and structure the Server Side Programming Concepts.
- Ability to Create and design Dynamic web Application.
- Write the structured code for JDBC (back end database).
- Ability to develop and design the enterprise level applications.

COMMUNICATION SKILLS-VII

Course Code: BCU 741 **Credit Units: 1**

Course Objective:

The course is designed to empower students to carry out day to day communication at the work place by adequate understanding of various types of communication to facilitate efficient interpersonal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Meetings**	**30% Weightage**
	• Notices • Circulars • Agenda • Minutes	
2.	**odule II Report Writing & Telephony Skills**	**25% Weightage**
	➢ **Report Writing** • Purpose/Significance • Types • Format ➢ **Telephony Skills** • Call Receiving/ Handling/ Concluding Etiquette • Voice Modulation • Effective Listening • Dos and Don'ts of Telephony Skills	
3.	**Negotiation Skills** • Definition/Concept • Purpose/ Significance • Checklist- Good & Bad Practices	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• The Great Trial-Robert Payne • The Home Coming - Rabindra Nath Tagore • How Much Land does a Man Need? - Leo Tolstoy • Valiant Vicky, The Brave Weaver - Flora Anne Steel All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
6.	**Student Learning Outcomes:** • Conduct all business activities related to the workplace with technical efficiency. • Contribute positively to the overall growth of the organization.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
T.N Chabbra , Business Communication , Sun India Publication.

Sanjay Kumar & Pushplata , Communication skills , Oxford University Press.

Reference: *Jones, Working in English, First Edition, Cambridge, CUP, 2001.*
AdditionalReading:NewspapersandJour

Behavioural Science - VII

Course Code: BSU-743 **Course Credit: 01**

Total Hours: 10

Course Objective

This course will help the students to:

- Explore interest and attitude
- Explore career opportunities
- Set career goals
- Developing attributes that employers value

Course Contents:

Module I: Career Planning **(2 Hours)**

- Importance of Career Planning & Development
- Career Development Plan
- Assessment of Career Development

Module II: Career Success: Interest, Aptitude & Attitude (Personality) **(2 Hours)**

- Interest, Aptitude & Attitude
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude

Module III: Explore Career for Growth **(2 Hours)**

- Selecting from available resources
- Career selection (Jobs)
- Career planning and development

Module IV: Self Reliance and Employability skills **(2 Hours)**

- Self awareness, Self promotion and Presentation, Self confidence
- Action planning, Networking, Negotiation
- Political awareness, Coping with uncertainty,
- Developing positive attributes at work place (personal and professional)
- Time Management as Self Management

Module V: Impression Management for Career Enhancement **(2 Hours)**

- Meaning & Components of Impression Management
- Impression Management Techniques(Influencing Tactics)
- Impact of Impression Management on Career Planning and Development

Student learning outcomes

- Students develop the ability to identify suitable career options and to create a suitable career plan based on the utilization of the counseling process, assessment tools, and other resources.
- Students will know how to assess their skills, interests and values.
- Students will know how to make informed career choices based on their self- assessment.
- Students will know how to explore relevant career options and build skills pertinent to those of greatest interest.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-VII

CourseCode:FLU744 **Creditunits:02**

CourseObjective:

Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable

- Todescribe anobject, compare objectsandevaluate
- Toaskforinformation, precision
- Tomake claims

CourseContents:

Dossier2–pg17-28,Dossier2:64millionsde consommateursActesdeCommunication:
Décrireunobjet(unbijouunique,unvoyageextraordinaire,unnouvelappareil photo)
Évaluerune chose (acheteruncadeau,discuterleprix)
Ouvriruncompteà la banque (demanderdesrenseignementsaubanquierafind'ouvriruncompte)
Demanderdes informations/précisions(précisionssurunproblème danslerelevéde compte)
Faire uneréclamation(s'adresserauservice après-vente pouréchangerunproduit défectueux)
Thèmesabordés:
S'habillerbonmarché (commentvoushabillez-vousbonmarché ?)
Le e-commerce (le portrait del'e-acheteurde votre pays)
Lesproduitscontrefaits(parlerdesproduitscontrefaits)
Laprofession:Lesmaraîchers(débats:commentéviterlegaspillage?lamodedeviedesdécroissants,privilégie-t- onla qualité oule prixlorsd'unachat?)

Grammaire :

7. Le pronom " en "
8. Laplace de l'adjectif
9. Le présent progressif
10. Le passé récent
11. Le futurproche(révision)
12. Le comparatifet le superlatif

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

SUMMER PROJECT - II

Course Code: BTB 760 **Credit Units: 06**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.

The students will be supervised by the internal faculty during the tenure of training.

The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

4. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

4.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

4.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

4.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

4.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

4.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

4.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

4.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

4.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

4.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

4.10 List of Acronyms and Standards

4.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

4.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report.

(Use prescribed format according to International guidelines)

4.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

5. Production of Project Report

5.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

5.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

5.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

5.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

5.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

6. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

6.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

6.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

6.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

6.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.5 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.5.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.5 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50

Total:

GENOMIC AND PROTEOMICS

Course Code: BTB 801 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics.

Course Contents:

GENOMICS

Module I: Genome Evolution

Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).

Module II: Structural Genomics

Chromosome structure and Genome organization, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.

Module III: Comparative Genomics

Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.

Module IV: Functional Genomics

ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools

Module V: Genotyping Background and Applications.

Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.

PROTEOMICS

Module VI: Fundamentals of Proteomics

Proteomics Basics and 2D Gel Electrophoresis,

Protein Identification and Analysis:

a. Protein preparation and Separationb. Protein Identification by mass spectrometryc. Identification of post translation modification

Protein Expression Mapping,High-throughput cloning of ORFs,Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease.

Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- Biotechnology and Genomics by P.K.Gupta

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
- DNA : Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

DRUG DELIVERY SYSTEMS

Course Code: BTB 802 **Credit Units: 03**

Course Objective:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)

Module III: Drug administration

Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery.

Current technologies and new and emerging technologies in oral delivery

Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

MANAGEMENT ACCOUNTING AND COST CONTROL

Course Code: BCH 621 **Credit Units: 01**

Course Objective:

The course aims to develop an understanding of the importance, language and techniques of Financial, Cost and Management accounting, skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making. Student should be able to understand the basic concepts of Company accounts with reference to the Indian context.

Course Contents:

Module I

Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements

Module II

Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application

Module III

Variable and Absorption costing, Job-Costing and Process-Costing Systems,

Module IV

Tools for planning and control, Master budget, Flexible Budgets and Variance analysis

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cost Accounting, C.Horngreen, Prenctice Hall
- Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

- Management Accounting, C. Horngreen, Prenctice Hall

PROJECT MANAGEMENT

Course Code: BCH 622 **Credit Units: 01**

Course Objective:

The course aims atmaking an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process. Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Course Contents:

Module I: Introduction
Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure

Module II: Project Training
Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.

Module III: Project initiation
Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control

Module IV: Managing Risk
Risk Management Process: Risk Identification, Risk Assessment.
Risk Response Development: Risk Response Control

Module V: Project Termination
Project Auditing and Termination

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:

- Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business.

ASP .NET

Course Code: CSE 804 **Credit Units: 03**
Total Hours: 30

Course Objective:
To create web based applications using ASP.NET and c#. Learns to create window based applications

Course Contents:

Module I: Introduction to .NET technologies (6 Hours)
Features of .NET, .NET Framework, CLR, MSIL, .NET class library, .NET Languages, CTS, assemblies, manifest, and metadata, What is ASP.NET?, Difference between ASP and ASP.NET.

Module II: Controls in ASP.NET (6 Hours)
Overview of Dynamic Web page, Understanding ASP.NET Controls, Applications, Web servers, Installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, validation Controls: Required Field Comparison Range. Calendarcontrol, Ad rotator Control, Internet Explorer Control.

Module III: Overview of ADO.NET and XML(8 Hours)
What is ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets , using Command & Data Reader, binding data to data bind Controls, displaying data in data grid, XML basics, attributes, fundamental XML classes: Document, text writer, text reader. XML validations, XML in ADO.NET, The XML Data Document.

Module IV: ASP.NET Applications(6 Hours)
Creating, tracking, caching, error handling, Securing ASP.NET applications- form based applications, window based application.

Module V: Web services(4 Hours)
Introduction, State management- View state, Session state, Application state, Building ASP.NET web services, working with ASP.NET applications, creating custom controls.

Course Outcomes:
The student will learn

- Develop dynamic web applications, create and consume web services
- Use appropriate data sources and data bindings in ASP.NET web applications
- Research and discover information about current topics, illustrate in an example, and present to the class.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**ESE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- ASP.NET Unleashed by Stephen Walther, SAMS publications

References:

- ASP.NET, Wrox Publications
- ASP.NET and VB.NET, Wrox Publication
- ASP.NET and C#.NET, Wrox publication.

GENOMICS AND PROTEOMICS LAB

Course Code: BTB 820 **Credit Units: 01**

Course Contents:

Module I

Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods

Module III

Gene finding tools and Genome annotation

Module IV

Comparison of two given genomes

Module V

Analysis of 2D – IEF data

Module VI

Microarray and Microarray data analysis

Module VII

Inference of protein function from structure

Module VIII

Inference of protein function and structure

Module IX

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ASP.NET LAB

Course Code: CSE 824 **Credit Units: 01**
Total Hours: 20

Course Objective:
This course is designed to provide the knowledge of Dot Net Frameworks along with C#

Software Required: Visual Studio and SQL server

Topics covered in lab will include the following Programs:

- Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
- Write a simple ASP.NET program to display the following Web Controls:

4. A button with text “clicks me”. The button control must be in the center of the form.
5. A label with a text hello.
6. A checkbox.

- The form name must be Web Controls
- Write a program to display “Welcome To Radiant” in the form when the “click” button is clicked. The form title must be ASP.NET.

IV. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.

- Write a program containing the following controls:

5. A ListBox
6. A Button
7. An Image
8. A Label

The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

VI. Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.
VII. Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.
VIII. Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.
IX. Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.
X. Check the length of the string in the TextBox using CustomValidator.

Course Outcomes:
After completion of the course the student will be able to use the features of Dot Net Framework along with the features of C#

Examination Scheme:

IA				**EE**	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL – VIII

Course Code: BCU 841 **Credit Units: 1**

Course Objective:
This course is designed to hone the creative minds of students to develop knowledge of diverse ethnic groups and cultures and to increase self-awareness for cultural competence and sensitivity.
Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Speaking in Public** • Essentials in Public Speaking • Parameters of Public Speaking	**45% Weightage**
2.	**Module II Cross Cultural Communication** • Culture and Context • Awareness & Significance of Understanding Culture • Ethnocentrism, Stereotyping and Cultural Relativism • Cultural Shock and Social Change	**45% Weightage**
3.	**Module III Prose**	**10% Weightage**
4.	• India Cinema: Tradition & Change-Chidananda Das Gupta • Kabuliwala-Rabindranath Tagore • The Duchess and the Jewelller -Virginia Woolf • The Park- James Mathews All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
	Student Learning Outcomes: • Students will be able to navigate cross cultural encounters in a global economy. • Facilitate students to develop learning to construct and deliver messages that incorporate the appropriate use of organizing content, language, vocabulary, kinesics, eye contact, appearance, visual aids, and time constraints.	
5.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
6.	**Assessment/ Examination Scheme:** (see tables below)	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
Raman, Meenakshi. Business Communication, Oxford
Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011
References:
Beamer, Linda. Intercultural Communication in the Global Workplace, Irwin/McGraw-Hill, 2005.
Reynolds, Sana & Deborah Valentine. Guide to Cross-cultural Communication, Prentice Hall, 2003.
Additional Reading: Newspapers and Journals.

Behavioural Science – VIII

Course Code: BSU-843 **Course Credit:01**
Total Hours: 10

Course Objective:
- To have a great deal of insight into one's character.
- Understanding of positive emotions
- To explore the dimensions of happiness, well-being, Optimism and hope
- Quick understanding of different situations and grasp new concepts.

Course Contents:

Module I: Positivity in personality **(2 Hours)**
- Importance of Positivity in personality
- Positivity Vs. Negativity
- Introspection and personal growth

Module II: Positive Emotions **(2 Hours)**
- Understanding positive emotions
- Importance of Positive emotion
- Types and identification of positive emotions (Love, happiness, Contentment, Resilience, etc.)

Module III: Hope, Optimism and Resilience **(2 Hours)**
- Positive approach towards future
- Benefits of Positive approach
- Resilience during challenge and loss

Module IV: Application of Positive Emotions **(2 Hours)**
- Application of positive emotions in relationships, and organizations
- Creating healthy organizational climate
- Positive emotions enhances performance.
-

Module V: Happiness and Well Being **(2 Hours)**
- Concept of Happiness & Well-Being
- Secret of happy mind and healthy life
- Work life balance.

Student learning outcomes:
Students develop the ability to identify and regulate positive emotions for personal and professional excellence.
- Students will know how to develop resilience.
- Students will know how to role of happiness to attain wellbeing.
- Students will know how to nurture personality by positivity.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan D. (2005). Information and Knowledge Management Macmillan India Ltd. Delhi.

Français-VIII

CourseCode:FLU844 **Creditunits:02**

CourseObjective:
Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable

- Toexpressanintention, announce a news, enquireaboutanevent
- To speakaboutthe future
- Todiscussthemedia

CourseContents:
Dossier3–pg29-40,Dossiers1&2(révision). Dossier3:Médias.frActesdeCommunication:
Parlerdel'avenir(lesavantageset lesinconvénientsdesréseauxsociaux)
Exprimeruneintention(poserdesquestion
ssurunforum) Parlerdesmédias
Engager/ terminerune conversation(demanderpourquoionn'a pasréponduaumèl)
Interrogersurunévénement
(vol,accident)
Annoncerunenouvelle (celle
de démission)
Thèmesabordés:
LesFrançaiset la presse (débat: Croyez-vousauxlégendesurbaines?)
LesFrançaisetInternet(débat:lesinformationsdelapresseécritesontplusfiablesquelesinformationss urInternet ?)
LatélévisiondesFrançais
Laprofession: Lesanimateursradio(débat : pouroucontre le téléchargement illégal de la musique oudesfilms)
Grammaire :

5. Le futursimple
6. L'hypothèse surlefutur
7. Lesformesde la négation
8. Lespronomscomplémentsdirectset indirects (révision)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:

- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

MAJOR PROJECT

Course Code: BTB 860 **Credit Units: 16**

Course Objective:
The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE
Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include
- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout
The report should contain the following components:

4. Project Report Organization
The Project report must be organized as follows. Format for few report pages is given after these guidelines:

4.1 Title of the Report
The title of the report should remain same as that given in the synopsis.

4.2 Title Page
The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

4.3 Declaration by the Students
This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

4.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

4.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

4.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

4.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

4.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

4.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

4.10 List of Acronyms and Standards

4.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

4.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

4.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

5. Production of Project Report

5.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

5.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

5.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

5.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

5.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

6. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

6.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

6.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

6.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

6.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- ## Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- ## Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- ## Abstract

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- ## Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

- ## Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- ## Review of Literature and Definition of Problem

- ## Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- ## Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- ## Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- ## Summary

- ## Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- ## References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.6 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.6.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.6 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	100
Viva Voce:	100
Total:	**200**

AMITY UNIVERSITY
MADHYAPRADESH

Bachelor of Science (Honours) Biotechnology

Programme Code: BSB

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2019 -2022

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2019

PROGRAMME OBJECTIVE

B. Sc. (H) Biotechnology aims to develop highly specialized hard core specialization in various diversified areas of biotechnology and its application to medicine, agriculture, environment, nutraceuticals and functional food etc.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research orientated project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practical conducted in well equipped laboratories in the area of Biotechnology, Animal Biotechnology & Immunology. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biotechnology.

PROGRAMME STRUCTURE

FIRST SEMESTER

Compulsory Courses							
Old Course Code	**New Course Code**	**Course Title**	**Lecture (L) Hours Per week**	**Tutorial (T) Hours Per week**	**Practical (P) Hours Per week**	**Total Credit**	**Page No.**
BSB 101	BSB 101	Cell Biology	3	-	-	3	
BSB 102	BSB 102	Maths& Biostatistics	3	-	-	3	
BSB 103	BSB 103	Plant Sciences – I	3	-	-	3	
BSB 104	BSB 104	Animal Sciences-I	3			3	
BSB 105	BSB 105	Chemistry – I	3	-	-	3	
BSB 120	BSB 120	Biotechnology Lab - I	-	-	2	1	
BSB 121	BSB 121	Chemistry Lab – I	-	-	2	1	
BSB 122	BSB 122	Plant Sciences Lab - I	-	-	2	1	
BSB 123	BSB 123	Animal Sciences Lab-I			2	1	
BSB 142	EVS 142	Environmental Studies - I		-	-	2	
		TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three (Hours/Sem)							
BSB 141	BCU 141	Communication Skill - I	30	-	-		
BSB 143	BSU 143	Behavioural Science - I	30	-	-		
BSB 144 BSB 145 BSB 146 BSB 147 BSB 148	FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses							
BSB 201	BSB 201	Introductory Biochemistry & Biophysics	3	1	-	4	
BSB 202	BSB 202	Bioanalytical Techniques	3	-	-	3	
BSB 203	BSB 203	Plant Sciences – II	3	-	-	3	
BSB 204	BSB 204	Animal Sciences-II	2	1		3	
BSB 205	BSB 205	Chemistry – II	3	-	-	3	
BSB 220	BSB 220	Biotechnology Lab – II	-	-	2	1	
BSB 221	BSB 221	Chemistry Lab – II	-	-	2	1	
BSB 222	BSB 222	Plant Sciences Lab – II	-	-	2	1	
BSB 223	BSB 223	Animal Sciences Lab-II	-	-	2	1	
BSB 242	EVS 242	Environmental Studies - II	2	-	-	2	
		TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB 241	BCU 241	Communication Skill - II	1	-	-	1	
BSB 243	BSU243	Behavioural Science - II	1	-	-	1	
BSB 244 BSB 245 BSB 246 BSB 247 BSB 248	FLU 244 FLU 245 FLU 246 FLU 247 FLU 248	Foreign Language - II French - II German Spanish Japanese Chinese	2	-	-	2	

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses							
BSB 301	BSB 301	Genetics	3	-	-	3	
BSB 302	BSB 302	Microbiology	3	-	-	3	
BSB 303	BSB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BSB 304	BSB 304	Anatomy & Plant Physiology	3	-	-	3	
BSB 305	BSB 305	Animal Physiology-I	2	1	-	3	
BSB 306	BSB 306	Chemistry – III	3	-	-	3	
BSB 320	BSB 320	Biotechnology Lab – III	-	-	4	2	
BSB 321	BSB 321	Chemistry Lab – III	-	-	2	1	
BSB 322	BSB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BSB 323	BSB 323	Animal Physiology Lab-I	-		2	1	
BSB 330	BSB 330	Term Paper (Evaluation)	-	-	-	2	
		TOTAL				**25**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB 341	BCU 341	Communication Skill - III	30	-	-		
BSB 343	BSU343	Behavioural Science - III	30	-	-		
BSB 344 BSB 345 BSB 346 BSB 347 BSB 348	FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses							
BSB 401	BSB 401	Bioinformatics	3	-	-	3	
BSB 402	BSB 402	Molecular Cell Biology	3	-	-	3	
BSB 403	BSB 403	Immunology	3	-	-	3	
BSB 404	BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BSB 405	BSB 405	Animal Physiology-II	3	-	-	3	
BSB 406	BSB 406	Chemistry – IV	3	-	-	3	
BSB 420	BSB 420	Biotechnology Lab - IV	-	-	4	2	
BSB 421	BSB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BSB 422	BSB 422	Animal Physiology Lab-II	-	-	2	1	
		TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB441	BCU 441	Communication Skill - IV	30	-	-		
BSB 443	BSU443	Behavioural Science - IV	30	-	-		
BSB 444 BSB 445 BSB 446 BSB 447 BSB 448	FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses							
BSB 501	BSB 501	Plant Biotechnology	3	-	-	3	
BSB 502	BSB 502	Animal Biotechnology	3	-	-	3	
BSB 503	BSB 503	Immunotechnology	2	-	-	3	
BSB 504	BSB 504	Genomics & Proteomics	3	-	-	3	
BSB 505	BSB 505	Recombinant DNA Technology	3	-	-	3	
BSB 506	BSB 506	Microbial Technology	3	-	-	3	
BSB 520	BSB 520	Biotechnology Lab - V	-	-	4	2	
BSB 521	BSB 521	Genomics & Proteomics Lab	-	-	4	2	
BSB 550	BSB 550	Summer Training (Evaluation)	-	-	-	5	
		TOTAL				**27**	
Optional Courses - Value Added Courses; Any Three							
BSB 541	BCU 541	Communication Skill - V	30	-	-		
BSB 543	BSU 543	Behavioural Science - V	30	-	-		
BSB 544 BSB 545 BSB 546 BSB 547 BSB 548	FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses							
BSB 601	BSB 601	Environmental Biotechnology	4	-	-	4	
BSB 602	BSB 602	Industrial Biology	4	-	-	4	
BSB 603	BCH 623	Principles of Management & Entrepreneurship Development	1	-	-	1	
BSB 620	BSB 620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BSB 660	BSB 660	Project (10-12 Week)	-	-	-	12	
		TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB 641	BCU 641	Communication Skill - VI	30	-	-		
BSB 643	BSU643	Behavioural Science - VI	30	-	-		
BSB 644 BSB 645 BSB 646 BSB 647 BSB 648	FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

CELL BIOLOGY

Course Code: BSB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology - Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker , Klinshmith& Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: BSB 102 **Credit Units: 03**

Course Objective:
The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course
Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II
Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III
Measure of central tendency and measure of dispersion
Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution
Simple problems involving Binomial, Poisson and Normal variables,

Module IV
Correlation and regression,
Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:
- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: **BSB 103** **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Algae
Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi
Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:, *Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes
Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:
- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: **BSB 104** **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.
-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:
-Protozoa: Type study of *Plasmodium.*
-Porifera: Type of *Sycon.*

Module III
-Coelnterata: Type study of *Ovelia.*
-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates
-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*
-Arthropoda: Type Study of *Prawn*

Module V:
Mollusca: Type Study of *Pila*
Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: **BSB 105** **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: **BSB 120** **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: **BSB 121** **Credit Units: 01**

Course Contents:
INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Plant Sciences - I

Course Code: BSB 122 Credit Units: 01

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Sciences - I

Course Code: BSB 123 Credit Units: 01

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: **BSB 141** **CreditUnits: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

ENVIRONMENTAL STUDIES – I

Course Code: BSB 142 Credit Units: 02

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies
Definition, scope and importance
Need for public awareness

Module II: Natural Resources
Renewable and non-renewable resources:
Natural resources and associated problems
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems
Concept of an ecosystem
Structure and function of an ecosystem
Producers, consumers and decomposers
Energy flow in the ecosystem
Ecological succession
Food chains, food webs and ecological pyramids
Introduction, types, characteristic features, structure and function of the following ecosystem:

e. Forest ecosystem
f. Grassland ecosystem
g. Desert ecosystem
h. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation
Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels
India as a mega-diversity nation
Hot-spots of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
Endangered and endemic species of India
Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: BSB 143 **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effect on personality
Building emotional competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning & Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and Nature of Attitude
Components and Types of Attitudes
Relevance and Importance of Attitudes

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, Components, Importance and Relevance
Positive and Negative Emotions
Healthy and Unhealthy expression of Emotions

Module VI:End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company

FRENCH - I

Course Code: **BSB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A:pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical :Unité 1: Découvrir la langue française : (oral et écrit)

4. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
5. dire/interroger si on comprend
6. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3 :Organiser son temps

8. dire la date et l'heure

Contenu grammatical :

1. organisation générale de la grammaire
9. article indéfini, défini, contracté
10. nom, adjectif, masculin, féminin, singulier et pluriel
11. négation avec « de », "moi aussi", "moi non plus"
12. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
13. pronom tonique/disjoint- pour insister après une préposition
14. futurproche

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BSB 201 **Credit Units: 04**

Course Objective:

Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Course Contents:

Module I: Nature of Biological materials
carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules
Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic
Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body
Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments
Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:

- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry - Voet&Voit

BIOANALYTICAL TECHNIQUES

Course Code: **BSB 202** **Credit Units: 03**

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Course Contents:

Module I: Instruments, basic principles and usage

pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques

Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis

Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

Plant Sciences - II

Course Code: BSB 203 **Credit Units: 03**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

Animal Sciences - II

Course Code: BSB 204 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: **BSB 205** **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I
Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II
Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III
Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV
Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V
Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:
- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – II (BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: **BSB 220** **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BSB 221 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH^{1+}, K^{1+}, CO^{2-}, S^{2-}, SO^{2-}, NO^{1-}, CH COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO^{1-}, SO^{2-}, C O^{2-}, PO^{3-}, BO^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: BSB 222 **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: BSB 223 **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear

Different types of important edible fishes of India

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Development of chick up to formation of primitive streak

Module V: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: BSB 241 CreditUnits: 01

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, MalraTreece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

ENVIRONMENTAL STUDIES – II

Course Code: BSB 242 Credit Units: 02

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

h. Air pollution
i. Water pollution
j. Soil pollution
k. Marine pollution
l. Noise pollution
m. Thermal pollution
n. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV: Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

INDIVIDUAL, SOCIETY AND NATION

Course Code: **BSB 243** **Credit Units: 01**

Course Objective:
To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Thinking skills
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking

Module II: Hindrances to Problem Solving
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving Process
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
Convergent and Divergent thinking
Idea generation and evaluation (Brain Storming)
Image generation and evaluation
Debating
The six-phase model of Creative Thinking: ICEDIP model

Module VI:End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: BSB 244 **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
To make them learn the basic rules of French Grammar.

Course Contents:

Module A : pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

4. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
5. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
6. Faire un programmed'activités

imaginer une conversation téléphonique/un dialogue
Propositions- interroger, répondre

Unité 4:Découvrir son environnement

5. situer un lieu
6. s'orienter, s'informer sur un itinéraire.
7. Chercher, décrire un logement
8. connaître les rythmes de la vie

Unité 5: s'informer

5. demander/donner des informations sur un emploi du temps passé.
6. donner une explication, exprimer le doute ou la certitude.
7. découvrir les relations entre les mots
8. savoir s'informer

Contenu grammatical:

1. Adjectifsdémonstratifs
8. Adjectifs possessifs/exprimer la possession à l'aide de :
   A. « de » ii. A+nom/pronom disjoint
9. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
10. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
11. passé composé
12. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

GENETICS

Course Code: BSB 301 Credit Units: 03

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Course Contents:

Module I
Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II
Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III
Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV
Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V
Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI
Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII
Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: BSB 302 **Credit Units: 03**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery, origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I: History and development of microbiology

Introduction, contribution of Scientists (Leeuwenhoek, Pasteur, Koch etc.), role of microorganisms in transformation of organic matter and in the causation of diseases. Pasteur's experiments, concept of sterilization, microscopy (optical, TEM and SEM), concept of microbial species and strains; general outline of various forms of micro-organisms.

Module II: Ultra Structure of Prokaryotic cell

Nature of the microbial cell surface, Prokaryotic structure and function - cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions, gram positive and gram negative bacteria and endospores.

Module III

Nutritional classification of microorganisms, isolation of auxotrophs (replica plating), analysis of mutations in biochemical pathways, microbial assays for vitamins and antibiotics, strain improvement by selection.

Module IV: Control of microorganisms

Methods of sterilization & disinfection (Physical agents &chemical agents)Antibiotics with special reference to antibacterial & antifungal antibiotics, mode of actions,drug resistance .

Module V: Microbial agents of diseases

Clinically important Bacterial & fungal diseases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **BSB 303** **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

ANATOMY & PLANT PHYSIOLOGY

Course Code: **BSB 304** **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Course Contents:

Module I
Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviour of cambium in *Achyranthes*, *Boerhaavia*, *Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II
Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III
Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV
Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: **BSB 305** **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSB 306 **Credit Units: 03**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III
(BASED ON GENETICS, MICROBIOLOGY, AND BIOCHEMISTRY AND METABOLIC REGULATION)

Course Code: BSB 320 **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation

Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human

Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.

Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.

Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BSB 321 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO $^{2+}$ as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BSB 322 Credit Units: 01

Course Contents:

Module I: Physiology
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.
Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.
Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)
Experimentation- Separations of photosynthetic pigments by thin layer chromatography.
Respiration – Determination of R.Q.
Module II: Plant Anatomy
Anatomy of normal dicot and monocot roots, stems & leaves
Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSB 323 Credit Units: 01

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar &Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

BehaviouralScience–III

CourseCode:BSU-343 CourseCredit:01

Course Objective:

To enable the students:
• Understand the process of problem solving and creative thinking.
• Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)
• What is thinking: The Mind/Brain/Behavior
• Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
• Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
• Perception
• Expression
• Emotion
• Intellect
• Work environment

Module III: Problem Solving (2 Hours)
• Recognizing and Defining a problem
• Analyzing the problem (potential causes)
• Developing possible alternatives
• Evaluating Solutions
• Resolution of problem
• Implementation
• Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
• Construction of POA
• Monitoring
• Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
• Definition and meaning of creativity
• The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
• The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes

▪ Student will be able to understand and solve the problems effectively in their personal and professional life.
▪ Students will outline multiple divergent solutions to a problem,
▪ Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

ExaminationScheme:

EvaluationComponents	Attendance	JournalofSuccess(JOS)	SocialAwarenessProgram(SAP)SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

SuggestedReadings:

• Michael Steven:Howto bea betterproblem solver,Kogan Page, NewDelhi, 1999
• GeoffPetty:Howto be betteratcreativity; Kogan Page, NewDelhi, 1999
• RichardY. Chang and P. Keith, Kelly:Wheeler Publishing,NewDelhi, 1998. •Phil Lowe KogePage:Creativityand Problem Solving, NewDelhi, 1996
• JWilliamPfeiffer(ed.)TheoriesandModelsinAppliedBehaviouralScience,Vol3,Management(1996); Pfeiffer&Company
• Bensley,AlanD.:CriticalThinkinginPsychology–AUnifiedSkillsApproach,(1998),Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Creditunits:02**

Course Objective:

Toenablethestudents

- totalkaboutthequalitiesanddefectsofpeople.
- toask/give directions,toenquireaboutalodging.
- toaskandgiveinformationsaboutacertainplace.
- todescribeeventsinpasttense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parlerdesqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,sesituerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage,
sesituerdanslemonde,exprimerletemps(avecindicateursde
temps–ilya,depuis),serenseignersurunhébergement,exprimerlasatisfactionetl'insatisfaction.

Grammaire :

6. lesadjectifsdémonstratifs
7. lesverbes:'irgroupe'devoir,falloir
8. lesprépositionsdelieu,depays
9. l'impératif,lepassécomposé,formeet accordduparticipepassé,lanégationaupassécomposé
10. lesindicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineetal.A proposA1Livre del'élève.Grenoble:PressesuniversitairesdeGrenoble,2010.
- Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:PressesuniversitairesdeGrenoble,2010.

Références:

- Girardeau,BrunoetNellyMous.RéussirleDELFA

TERM PAPER

Course Code: BSB 330 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject. The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

7. Choosing a subject
8. Finding sources of materials
9. Collecting the notes
10. Outlining the paper
11. Writing the first draft
12. Editing & preparing the final paper

7. Choosing a Subject

The subject chosen should not be too general.

8. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

9. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

10. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

11. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is.

You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

12. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

11) Title page
12) Acknowledgement
13) Abstract
14) Table of contents
15) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
16) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
17) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
18) Results (If any)
19) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
20) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

f) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[3] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[4] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts,) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOINFORMATICS

Course Code: BSB 401 **Credit Units: 03**

Course Objective:

The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Course Contents:

Module I: Computers

General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics

Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases

Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification.

Module V: Genome analysis

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:

- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: **BSB 402** **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic informations are stored, expressed and transmitted among generations.

Course Contents:

Module I: Introduction to Moleculer Biology,

Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.

Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.

Module II:Insertion elements, transposons and retrotransposons

Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.

Application of genetic engineering

Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes

Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.

Module III: Structure of prokaryotic and eukaryotic genes

Transcription mechanism in prokaryotes and eukaryotes.

Translation : Translation mechanisms in prokaryotes and eukaryotes.

Module IV: Gene Expression in prokaryotes

Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)

Module V:Eukaryotic geneExpression

Overview of gene expression, polyadenylation, cap formation, RNA degradation.

Module VI: Oncogenes and Tumor Suppressor genes

Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY

Course Code: BSB 403 **Credit Units: 03**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I
Historical perspective of immune system and immunity; Innate and specific immunity.

Module II
Humoral immunity and Clonal selection theory;

Module III
Cell-mediated immunity.

Module IV
The organs and cells of the immune system.

Module V
Histocompatibility: structure of MHC class I, II & III antigens & their mode of antigen presentation, MHC restriction; Antigens & antigenicity;

Module VI
Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Course Contents:

Module I
Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.
Module II
Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding
Module III
General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.
Module IV
Economic importance with special reference to plants yielding:
e) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
f) Common fibre yielding plants - Cotton, Jute .
g) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
h) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BSB 405 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals
- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:
- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:
- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization
-

Module IV:Developmental Biology:
- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: BSB 406 **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic & non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates
Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II
General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III
General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV
Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics
Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry
Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry
Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY – IV LAB
(BASED ON BIOINFORMATICS, MOLECULAR CELL BIOLOGY, IMMUNOLOGY)

Course Code: BSB 420 **Credit Units: 02**

Course Contents:

Module I: Computers
Handling of computers and Data analysis using Oracle (create, append, delete, pack, display, list count, set, order, index, sort)

Module II: Bioinformatics
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.

Module III
Isolation of nuclear DNA (genomic & plasmid DNA)

Module IV
Blood film preparation &identification of blood cells
Study of blood groups
Study of ELISA.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSB 421 **Credit Units: 01**

Course Contents:

Module I: Embryology
Study of permanent slides of the**:**
g) T.S. anther, pollen, germinating pollen
h) L.S. ovule types
i) Endosperm
j) Embryos
k) L.S. caryopsis
l) Dissection of embryo

Module II:Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code:BSB 422 **Credit Units: 01**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland

- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.

- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- IsmatChughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred& Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.***

Additional Reading: Newspapers and Journals.

BehaviouralScience-IV

CourseCode:BSU-443 **CourseCredit:01**
TotalHours:10

CourseObjective:
This course aims at imparting an understanding of Values, Ethics& Moralityamongstudents formakinga balanced choice between personal& professional development.

CourseContents:

ModuleI:IntroductiontoValues&Ethics **(2Hours)**
Meaning & itstype
Relationship between Valuesand
Ethics Its implication inone's life

ModuleII:ValuesClarification&Acceptance **(2Hours)**
CoreValues-Respect, Responsibility, Integrity, Resilience,Care,&
Harmony Its process-SelfExploration
Nurturing Goodvalues

ModuleIII:Morality **(2Hours)**
Difference
betweenmorality,ethics&values
Significance ofmoralvalues

ModuleIV:EthicalPractice **(2Hours)**
Ethical Decisionmaking
Challenges in its
implementation
Prevention
ofCorruption&Crime

ModuleV:Personal&ProfessionalValues **(2Hours)**
Personal values-Empathy,honesty, courage,
commitment Professional Values-Work ethics,
respect for others
Its role in personalitydevelopment Character building- New-self awarness

Studentlearningoutcomes

- Able to answerthe question: WhatdoIstand for?
- Abilitytoapplya coherentsetof moralprinciples within professional andspecialized contexts
- Willingto make unpopularbut right decision
- Committed toworkingfor justiceand peacelocallyand globally.

ExaminationScheme:

EvaluationComponents	Attendance	JournalofSuccess (JOS)	SocialAwarenessProgram(SAP) SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

Text&References:

Cassuto Rothman, J. (1998). Fromthe FrontLines, Student Casesin Social Work Ethics.NeedhamHeights, MA: Allyn and Bacon.
Gambrill, E. &Pruger,R. (Eds). (1996).Controversial Issues in Social Work Ethics, Values, & Obligations. NeedhamHeights, MA:Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthelanguage ofthestudent’sinbothoralandwritten

Torevisethe grammarinapplicationandthecommunicationtasksrelatedtotopicscoveredalready

Togetacquaintedwiththecurrent socialcommunicationskills,oral(dialogue,telephoneconversations,etc.)and writtenandperformsimplecommunicationtaskssuchas

- talkingaboutpersonalhabits
- narratingeventsinthepast,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’ exprimer autéléphone,demanderetdonnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionoraleet écrite.

Grammaire :

4. l’imparfait,
5. lacomparaisonduverbe/dunom ; mieux/meilleur
6. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:

Text:

Le livre àsuivre:

Andant,Christineetal.A proposA1Livre del’élève.Grenoble:PressesuniversitairesdeGrenoble, 2010.

Andant,Christineetal.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,BrunoetNellyMous.RéussirleDELFA1.Paris: Didi

PLANT BIOTECHNOLOGY

Course Code: BSB 501 **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micropropagation.

Course Contents:

Module I: Introduction to in vitro methods
Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications
Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation
Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants
Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: **BSB 502** **Credit Units: 03**

Course Objective:

The aim of the course is to provide equal importance to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I

Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines.

Module II

Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module III

Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF,erythropoietin).

Module IV

Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication.

IMMUNOTECHNOLOGY

Course Code: **BSB 503** **Credit Units: 02**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to mankind.

Course Contents:

Module I
Immunoglobulin gene: genetic basis of reation of antibody diversity; Effect of T cell functions.

Module II
Measurement of antigen – antibody interaction: agglutination, immunodiffusion, immuno-electrophoresis, ELISA, RIE, production of monoclonal antibodies.

Module III
Antibodies in targeting therapeutic agents.

Module IV: Hybridoma Technology
Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application

Module V
Tissue and organ transplant

Module VI
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination.
Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman.

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company.
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins.
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

GENOMICS& PROTEOMICS

Course Code: BSB 504 **Credit Units: 02**

Course Objective:
The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Course Contents:
GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome : 2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BSB 505 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Course Contents:

Module I

Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II

Methods of DNA Introduction into living cells.

Module III

Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV

Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V

Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.

PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene cloning and DNA analysis by T.A. Brown

References:

- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

MICROBIAL TECHNOLOGY

Course Code: **BSB 506** **Credit Units: 03**

Course Objective:

The basic knowledge of Microbiology gained in the previous semester would the applied in the various disciplines like evolution, Immunology & Industrial fermentation**.**

Course Contents:

Module I

Microbial nutrition and growth -The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module II

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module III

Host-parasite relationship (Normal micro flora of skin, oral cavity, gastrointestinal tract), types of toxins (Exo, endo, entero) and their structure and mode of actions, Microbe Interactions with other populations.

Module IV

Microbes in extreme environments: Archae as the earliest forms, thermophiles, pyshrophiles, halophiles, alkalophiles, acidophiles , hyperthermophiles.

Module V

Introduction to industrially important microbes and microbial fermentative products (Production of antibiotics with special refernce to penciliin& streptomycin, enzymes, biotransformation of steroids), food products from microbes (Dairy &SCP etc)

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOTECHNOLOGY LAB – V(BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BSB 520 **Credit Units: 02**

Course Contents:

Module I
Sterilization techniques of glass wares &equipments.
Preparation of cotton plugs & culture media .
Preparation and sterilization .of different explants.
Inoculation of explants on culture media.

Module II
Culture of plant embryos/seeds.Callus culture, Testing of seed viability.

Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

Module IV
Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD &*E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BSB 521 **Credit Units: 02**

Course Contents:

Module I
Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II
Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III
Comparison of two given genomes- Mummer.

Module IV
Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary** • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	**35% Weightage**
2.	**Module II Comprehension Skills** • Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	**25% Weightage**
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools.	
6.	**Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text:Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

CourseCode:BSU-543 **CourseCredit:01**
TotalHours:10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

EvaluationComponents	Attendance	JournalofSuccess(JOS)	SocialAwarenessProgram(SAP)SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann&Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthelanguage ofthestudent'sinbothoralandwritten

Torevisethe grammarinapplicationandthecommunicationtasksrelatedtotopicscoveredalready

Togetacquaintedwiththecurrent socialcommunicationskills, oral (dialogue, telephoneconversations,etc.)Andwrittenandperformsimplecommunicationtaskssuchas

- narratingeventsinthepast,markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriatelogical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivreensemble

ActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,

l'écologie,identifieretdécrirelesdifférencesdecomportement,décrirele fonctionnementd'uneassociation,fairelabiographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionoraleet écrite.

Grammaire :

5. le présent (révision),lepassécomposé(révision)
6. lespronomscomplémentsdirects,lespronomscompléments indirects
7. lesmarqueurschronologiques
8. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineetal.A proposA1Livre del'élève.Grenoble:PressesuniversitairesdeGrenoble,2010.

· Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,BrunoetNellyMous.RéussirleDELFA1.Paris: Didier,2010.

SUMMER TRAINING

Course Code: BSB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of Summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

4. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

4.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

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The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

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This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

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This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

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4.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

4.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

4.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

4.10 List of Acronyms and Standards

4.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.

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4.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

5. Production of Project Report

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The maximum number of pages of the Report should be preferably between 30-50 pages.

5.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

5.3 Single-Sided Printing

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Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

- This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BSB 601 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Course Contents:

Module I
Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II
Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III
Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV
Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V
Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:
- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code:BSB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Course Contents:

Module I

Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II

Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III

Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, SCP.

Module IV

Production of fermented dairy products

Module V

Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Industrial Microbiology – Cassida

References:

- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot &Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: **BCH 623** **CreditUnits: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code:BSB 620 **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: **BCU 641** **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials** • Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	**30% Weightage**
2.	**Module II Workplace Interpersonal Skills** • Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	**25% Weightage**
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose** • Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	**10% Weightage**
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology).*Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
iv)express their sentiments, emotions and opinions, reacting to information, situations;
v) narrate incidents, events;
vi) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12
Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire uneréservation

Contenu grammatical:

2. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BSB 660 **CreditUnits: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
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Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.4 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.4.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.4 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

AMITY UNIVERSITY

MADHYAPRADESH

Master of Science (Biotechnology)

Programme Code: MSB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2019 - 21

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.
This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.
The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAM OBJECTIVE

The objective of Masters Programme in Biotechnology of Amity University is to develop multifaceted academically excellent students in various areas of Biotechnology. The course also aims to enhance the knowledge gained by them in the undergraduate curriculum so as to make them competent for future, academic or industrial pursuits.

The subjects included in the course curriculum suffice for both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practicals conducted in well-equipped laboratories. Subjects like Cell Biology, Genetics, Enzymology, Microbiology, Plant Biotechnology, Animal Biotechnology, and Immunology have contents with molecular approach so as to fulfill the requirements of current research and developmental needs. Industry oriented subjects like bioprocess engineering, downstream processing is taught for imparting knowledge of biotechnological application in industry.
In addition, molecular biology and recombinant DNA Technology is taught at advanced levels as they form the core foundation of biotechnology and biotechnological processes.

Therefore the present postgraduate curriculum in Biotechnology is aimed to produce highly motivated challenging young biotechnologist to take our country on the path of Biotechnology revolution.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MSB101	Advanced Biochemistry	3	-	-	3	
MSB102	Advanced Microbial Technology	3	-	-	3	
MSB103	Biophysics & Bioanalytical Techniques	3	-	-	3	
MSB104	Advanced Cell Biology & Genetics	3	1	-	4	
MSB105	Advanced Biostatistics for Biologists	3	-	-	3	
MSB106	Computer Applications	3	-	-	3	
MSB120	Biochemistry Lab	-	-	4	2	
MSB121	Advanced Microbial Technology Lab	-	-	2	1	
MSB122	Cell Biology & Genetics Lab	-	-	2	1	
MSB123	Computer Applications Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB141	Advanced Communication	30	-	-		
MSB143	Self-Development for Interpersonal	30	-	-		
	Foreign Language - I	30	-	-		
MSB144	French					
MSB145	German					
MSB146	Spanish					
MSB147	Japanese					
MSB148	Chinese					

SECOND SEMESTER

Compulsory Courses:						
MSB201	Advanced Molecular Biology	4	-	-	4	
MSB202	Advances in Genetic Engineering	4	-	-	4	
MSB203	Bioprocess Technology	4	-	-	4	
MSB204	Advanced Genomics & Proteomics	4	-	-	4	
MSB205	Computational Biology	3	-	-	3	
MSB206	Environmental Biotechnology	3	-	-	3	
MSB220	Advanced Molecular Biology Lab	-	-	4	2	
MSB221	Genetic Engineering Lab	-	-	4	2	
MSB222	Bioprocess Technology Lab	-	-	4	2	
MSB223	Advanced Genomics & Proteomics Lab			2	1	
MSB224	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB241	Communicational for Employment	30	-	-		
MSB243	Conflict Resoultion and Management	30	-	-		
	Foreign Language - II	30	-	-		
MSB244	French					
MSB245	German					
MSB246	Spanish					
MSB247	Japanese					
MSB248	Chinese					

SUMMER INTERNSHIP OF 09 -12 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MSB301	Advanced Immunology	3	-	-	3	
MSB302	Enzyme Technology	3	-	-	3	
MSB303	Drug Design & Development	3	-	-	3	
MSB304	Advanced Animal Biotechnology	3	-	-	3	
MSB305	Advanced Plant Biotechnology	3	-	-	3	
 MSB306 MSB307 MSB308 MSB309 MSB310 MSB311	**Elective (Select any One)** • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
MSB320	Advanced Immunology Lab	-	-	2	1	
MSB321	Enzyme Technology Lab	-	-	2	1	
MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
MSB350	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP341	Advanced Communication - III	30	-	-		
BSP343	Behavioral Science - III	30	-	-		
 FLP344 FLP345 FLP346 FLP347 FLP348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
MSB460	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

ADVANCED BIOCHEMISTRY

Course Code: MSB 101 **Credit Units: 03**

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Course Contents:

Module I

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module II: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module III: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module IV: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module V: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VI: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), Lubert Stryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: **MSB 102** **Credit Units: 03**

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Course Contents:

Module I: Introduction to microbiology
Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms
Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics
Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation. Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology
Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: MSB 103 Credit Units: 03

Course Objective:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Course Contents:

Module I: Membrane Biophysics
Genesis of membrane potential in nerve & membrane, Nerst & Goldman equation, Patch Clamp and Voltage – Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**
- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: **MSB 104** **Credit Units: 04**

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and subcellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.

Extrachromosomal inheritance:, Mitocondrial and chloroplast genetic code

Chromosomal aberration and polyploidy

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage.

Population genetics- Hardy weinbergs selection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase, Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer, cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MSB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics
Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II
Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics
Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV
Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: MSB 106 Credit Units: 03

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers

Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office

Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.

Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system

Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce

Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language

Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF .. ELSE statements – Looping concepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj & Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: MSB 120 Credit Units: 02

Course Contents:

Module I: Proteins
Identification of protein by Biuret test.
Quantitation of protein by Bradford method
Separation of proteins by SDS-PAGE

Module II: Enzyme
Enzyme activity study of serum alkaline phosphatase

Module III: Nucleic Acid
Biochemical estimation of DNA
Biochemical estimation of RNA
Separation of DNA on Agrose gel.

Module IV: Carbohydrate
Biochemical estimation of blood sugar

Module V: Lipids
Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

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ADVANCED MICROBIAL TECHNOLOGY LAB

Course Code: MSB 121 Credit Units: 01

Course Contents:

Module I
Aseptic techniques: preparation of culture media for cultivation of specific microorganism.
Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II
Biochemical test - Indole test. methyl red test. voges proskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III
Isolation of special microbes from environment by isolation and enrichment techniques
Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD
Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV
Antibiotic sensitivity test by disc diffusion assay

Module V
Biochemical and molecular characterization of micro organisms
Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: MSB 122 **Credit Units: 01**

Course Contents:

Module I
Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II
Isolation of chloroplast from spinach and study of electron transport chain.

Module III
Isolation of mitochondria and study of electron transport chain.

Module IV
Study of apoptosis by TUNEL method.
Site directed mutagenesis
Mutation detection and analysis
Mitosis
Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: MSB 123 **Credit Units: 01**

Course Contents:

Module I: Ms-Office
Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003
Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language
Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

ADVANCED COMMUNICATION

Course Code: **MSB 141** **Credit Units: 01**

Course Objective:

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: **MSB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MSB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1, 2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

4. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
5. dire/interroger si on comprend
6. Nommer les choses

Unité 2: Faire connaissance

3. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
4. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

8. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
9. article indéfini, défini, contracté
10. nom, adjectif, masculin, féminin, singulier et pluriel
11. négation avec « de », "moi aussi", "moi non plus"
12. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
13. pronom tonique/disjoint- pour insister après une préposition
14. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED MOLECULAR BIOLOGY

Course Code: **MSB 201** **Credit Units: 04**

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Course Contents:

Module I: DNA replication and repair
DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA
Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA
Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation
Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.

Module V: Regulation of gene expression
Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing
RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme
Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: MSB 202 Credit Units: 04

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes. Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: MSB 203 Credit Units: 04

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: MSB 204 Credit Units: 04

Course Objective:
The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

PART I: GENOMICS

Module I
Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II
Transcriptomics and metatranscriptomics: Introduction , method and uses. genetic mapping

Module III
Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV
Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V
Introduction to proteomics
Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI
Post translational protein modification

Module VII
Protein – protein interaction some examples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: **MSB 205** **Credit Units: 03**

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

8. Major information Resources & Databases in Bioinformatics
   a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
   b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
   c. Derived (Secondry) Databases of Sequences and structure:
      i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
      ii. SCOP, CATH, DSSP, FSSP, RNAbase,
   d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
9. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
10. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
11. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
12. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
13. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
14. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)
Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.
Suffix tree and its applications in Bioinformatics
Gene Indentification Methods
Predictive Methods using DNA and Protein sequences.
Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.
Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.
Phylogenetics analysis software.
Molecular Structure drawing tool.
Molecular modeling/Docking.
Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

***References*:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MSB 206** **Credit Units: 03**

Course Objective:

The objective of this course is to familiarize the students with the processes and micro organism that can be employed for a cleaner environment. The students will be applying basic knowledge of microbiology for developing the practices for a cleaner environment, water, fuel, fertilizer, pesticides etc. The course also aims to make the students aware of legislation and acts prevalent to control the degradation of our eco system.

Course Contents:

Module I

Treatment of municipal wastes and industrial effluents (Physico-Chemical, biological analysis of waste water), Rr. Sec and test waste water treatment sludge treatment and disposal treatment of wastes from paper, textile, dairy, petrochemical and pharmaceutical industry .

Module II

Bioremediation and phytoremediation of toxic compounds like pesticides, hydrocarbons, polymers, surfactants, biotransformation and bioaccumulation

Module III

Renewable and non-renewable energy resources, clean fuel technology, biofuels.

Module IV

Biofertilizers and biopesticides – a cleaner agricultural practice, concept of N_2 - fixation, azolla, cyanobacteria, Rhizobium and VAM as biofertilizers.

Module V

Biomining – microbe assisted microbial leaching, bioaccumulation and bio sorption
Biosensors and biomarkers for ecotoxicity measurement, EIA and Environmental audit.

Module VI

Principles in ecotoxicology; animal toxicity tests; statistical concepts of LD_{50}; dose-effect and dose response relationship; frequency response and cumulative response; Biological and chemical factors and influence toxicity; global dispersion of toxic substance; dispersion and circulating mechanisms of pollutants; Aquatic toxicity testes; statistical tests; response of planktons to toxicants; EC_{50};

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Introduction to Environmental Biotechnology, Milton Wainwright

References:

- Waste Water Engineering, Metcalf and Eddy. Publisher: Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, Jonh F.T. Spencer
- Principles of Environmental Engineering, Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: **MSB 220** **Credit Units: 02**

Course Contents:

9. Isolation of genomic DNA from prokaryotic and Eukaryotes.
10. Isolation of plasmid.
11. Study of DNA protein interaction.
12. Study of in vitro transcription.
13. Study of DNA methylation.
14. Study of DNA repair mechanism.
15. Invitro study of translation
16. Isolation of RNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: **MSB 221** **Credit Units: 02**

Course Contents:

8. Study of gene expression in E.coli.(GFP cloning).
9. Study of Southern Hybridization.
10. Study of RFLP/RAPD.
11. Study of Western blotting.
12. Study of restriction digestion.
13. Study of legation.
14. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: MSB 222 Credit Units: 02

Course Objective:
The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I
Isolation of industrially important micro organisms for microbial processes.

Module II
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III
Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV
Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: MSB 223 Credit Units: 01

Course Objective:
The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I
Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II
PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III
Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF data using PDquest software

Module IV
Primer designing, Analysis of protein 3D structures and comparison,. Micro array and Micro array data analysis, Inference of protein function from structure

Module V
Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: **MSB 224** **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MSB 241** **Credit Units: 01**

Course Objective:
To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: **MSB 243** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MSB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

4. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
5. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
6. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

5. situer un lieu
6. s'orienter, s'informer sur un itinéraire.
7. Chercher, décrire un logement
8. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED IMMUNOLOGY

Course Code: **MSB 301** **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.
Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: MSB 302 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes
Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

DRUG DESIGN AND DEVELOPMENT

Course Code: **MSB 303** **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

***References*:**

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: **MSB 304** **Credit Units: 03**

Course Objective:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Course Contents:

Module I

Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II

Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III

DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV

Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V

Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: **MSB 305** **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques

Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II

Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III

Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV

Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V

Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DELIVERY SYSTEMS

Course Code: **MSB 306** **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MSB 307** **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I

Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III

DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs**.**

Module IV

Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations

Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14 Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MSB 308** **Credit Units: 03**

Course Objective:

The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:
- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: **MSB 309** **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases. Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: **MSB 310** **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code : MSB 311 **Credit: 03**

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

6. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
7. Organizational Structure and management
8. Capital Management
9. Product innovation and management
10. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

4. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
5. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
6. Basics of material management

Module III

5. Kaizen { Continuous improvement in product and management }
6. Six Sigma
7. Biotech enterprises: Small, Medium and Large.
8. Quality control in Biotech industries.

Module IV

5. Government Regulations for Biotech product.
6. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
7. Business development for medical products.
8. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne & Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

.ADVANCED IMMUNOLOGY LAB

Course Code: MSB 320 **Credit Units: 01**

Course Contents:

8. Purification of immunoglobin G.
9. Study of antigen- antibody pattern (ODD).
10. Study of sandwich ELISA.
11. Study of haemeagglutination.
12. Study of immunoelectrophoresis.
13. Isolation and identification of rosette cells.
14. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ENZYME TECHNOLOGY LAB

Course Code: MSB 321 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: **MSB 322** **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

7. Histological study of important animal tissues.
8. Estimation of enzyme activity from animal tissues.
9. Study of toxicity on invitro model.
10. Culture and maintenance of animal cell lines.
11. Culture of chicken fibroblasts.
12. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

7. Tissue culture lab and organization. Sterilisation of glasswares, tools and equipments.
8. Preparation of stocks and media. Surface sterilization of various explants
9. ORGAN CULTURE
10. Cllus culture
11. Anther culture
12. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED COMMUNICATION –III

Course Code: BCP 341 **Credit Units: 01**

Course Objective:

The course is designed to develop competence in communication skills related to production & presentation of messages in multiple formats & understand the importance of body language.

Prerequisites: NIL

Module I Written Communication	**40% Weightage**
• Coherence and Structure • Précis Writing • Writing Paragraphs & Essays	
Module II Developing Writing Skills	**30% Weightage**
• Business Letter/Official Correspondence • Social Correspondence • Emails & Netiquette	
Module III Business Presentations	**30% Weightage**
• Planning, Design and Layout of Presentation • Contents : Information Packaging & Delivery • Personal Branding	
Student Learning Outcomes	
The student will be able to write impressive official correspondence and also learn to make and give effective presentations in a professional environment.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994
Lesikar & Flatley, Basic Business Communication, Tata McGraw- Hill Edition

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)
Business Communication for Managers, Payal Mehra Pearson 2012
Additional Reading: Newspapers and Journal.

BEHAVIOURAL SCIENCE – III

Course Code: BSP-343 **Course Credit: 01**

Course Objective:

This course will help the students to:

- Importance of Personal and Professional excellence
- Inculcating the components of excellence
- Explore interest, attitude and Explore career opportunities
- Set career goals

Course Contents:

Module I: Professional Competence **(2 Hours)**

- Understanding Professional Competence
- Component of Competence:

  Knowledge
  Skills
  Attitude
  Self awareness
  Self Promotion & Presentation,
  Self confidence
  Skills
  Performance
- Political awareness, Coping with uncertainty
- Developing positive attributes at work place (personal and professional)
- Time management
- Handling criticism and interruptions
- Managing difficult people
-

Module II: Managing Personal Effectiveness **(2 Hours)**

- Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness)
- Integration of personal and organizational vision for effectiveness
- A healthy balance of work and play

Module III: Components of Excellence **(2 Hours)**

- Positive Imagination & Focused
- SMART Goal
- Controlling Distraction
- Commitment
- Constructive Evaluation
- Creativity & Success

Module IV: Career Development **(2 Hours)**

- Understanding Development Process
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude
- Selecting from available resources
- Career planning and development

Module V: Personal & Professional Success **(2 Hours)**

- Career Selection & Motivation.
- Action planning Networking Negotiation.
- Accept Change & Challenge for Successful career.

Student learning outcomes:

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers
- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan, D. (2005). Information and Knowledge Management, Macmillan India Ltd. Delhi

Français-III

CourseCode:FLP 344 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutwork andproblemsrelatedtowork
- toperform simple communicative tasks(explaininga setback,askingforapostponementofappointment,give instructions,place orders,reserve, holda telephone conversation,write e-mails,replytomessages)
- toprepare arésumé andtoappearforinterviews

CourseContents:

Unité 5, 6:pp. 74to104

Actesde communication:

Unité 5:Travail

6. mangeraurestaurant,comprendreunmenu,commander
7. engagerune conversationtéléphonique
8. présentersonrésumé: parlerde sa formation,de sonexpérience,de ses compétences
9. raconterdesévénementspassés
10. consultersa boîte e-mails,répondreauxmessages

Unité 6:Problèmes

6. identifierunproblème,demanderdesprécisions
7. expliqueruncontretemps,déplacerunrendez-vous
8. demanderde l'aide (partéléphone,pare-mail)
9. donnerdesinstructions
10. expliquerunproblème,suggérerunesolution.

Grammaire :

11. futur proche, articles partitifs, un peu de, beaucoup de, une bouteille de, Un morceau de.
12. pronoms COD, venir de + infinitif, verbes appeler (au présent)
13. passé composé avec avoir, affirmatif et interrogatif, savoir et connaître
14. passé composé avec être, accord du participe passé, négation
15. pronoms COI, être en train de
16. ne…rien, ne…personne, ne…plus, ne…pas encore, qu'est-ce que/ qu'est-ce qui/qui est-ce que/qui est-ce qui.
17. passé composé des verbes pronominaux.
18. si/quand+présent, ne…plus, ne …pas encore.
19. impératif présent (2) place du pronom et verbes pronominaux.
20. Trop /pas assez, verbe devoir au conditionnel présent.

Examination Scheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage (%)	15	10	5	**30**	**70**	**100**

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

SUMMER INTERNSHIP

Course Code: MSB 350 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

4. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

4.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

4.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

4.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

4.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

4.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

4.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

4.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

4.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

4.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

4.10 List of Acronyms and Standards

4.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

4.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

4.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

5. Production of Project Report

5.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

5.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

5.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

5.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

5.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

6. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

6.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

6.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

6.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

6.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

6.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

6.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

6.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- ### Title or Cover Page

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- ### Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- ### Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- ### Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- ### Review of Literature and Definition of Problem

- ### Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article
Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.
For book:
Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: MSB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(vi) Long Tables
(vii) Long quotations
(viii) Foot notes
(ix) Multilane captions
(x) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[6] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[7] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[8] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[9] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[10] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[10] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[11] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[12] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY
MADHYA PRADESH

Master of Technology (Biotechnology)

Programme Code: MTB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2019 – 21

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAMME OBJECTIVE

Biotechnology is the technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.The main objective of this programme is to provide a balanced and comprehensive knowledge of the basic as well as applied sciences related to Biotechnology that would enhance the basic aptitude of each student and prepare them to take up the challenges in the varied and multi-faceted applications of Biotechnology. It will empower the students with the latest tools, techniques and awareness in biotechnology and will facilitate comprehensive learning combining the scientific and technological aspects

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB101	Biochemistry & Metabolic Regulation	4	-	-	4	
MTB102	Advanced Microbial Technology	4	-	-	4	
MTB103	Instrumentation in Biotechnology	4	-	-	4	
MTB104	Bioinformatics	4	-	-	4	
MTB105	Advance Biostatistics for Biologists	3	-	-	3	
MTB120	Biochemistry Lab	-	-	4	2	
MTB121	Microbiology Lab	-	-	2	1	
MTB122	Instrumentation in Biotechnology Lab	-	-	2	1	
MTB123	Bioinformatics Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB141	Advanced Communication	30	-	-		
MTB143	Self-Development for Interpersonal Skills	30	-	-		
 MTB144 MTB145 MTB146 MTB147 MTB148	Foreign Language - I French German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB201	Cell & Molecular Biology	4	-	-	4	
MTB202	Recombinant DNA Technology	4	-	-	4	
MTB203	Bioprocess Technology	4	-	-	4	
MTB204	Genomics & Proteomics	4	-	-	4	
MTB205	Pharmaceutical Biotechnology	3	-	-	3	
 MTB206 MTB207 MTB208 MTB209 MTB210 MTB211	**Elective-I (any one)** • Environmental Biotechnology • Biosensors • Artificial Neural Networks • Agriculture Biotechnology • Fundamentals of Computers & Programming in "C" • Bio-energy Engineering	3	-	-	3	
MTB220	Cell & Molecular Biology Lab	-	-	4	2	
MTB221	Recombinant DNA Technology Lab	-	-	4	2	
MTB222	Bioprocess Technology Lab	-	-	4	2	
MTB223	Genomics & Proteomics Lab	-	-	2	1	
	TOTAL				**29**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB241	Communicational for Employment	30	-	-		
MTB243	Conflict Resoultion and Management	30	-	-		
 MTB244 MTB245 MTB246 MTB247 MTB248	Foreign Language - II French German Spanish Japanese Chinese	30	-	-		

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SUMMER PROJECT: 8 - 10 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MTB301	Immunology & Immunotechnology	4	-	-	4	
MTB302	Enzymology & Enzyme Technology	4	-	-	4	
MTB303	Drug Design & Development	4	-	-	4	
MTB304	Bioprocess Plant Design	3	-	-	3	
 MTB305 MTB306 MTB307 MTB308 MTB309 MTB310	**Elective - II (any one)** • Pollution Prevention Fundamentals • Drug Delivery Systems • IPR, Biosafety & Bioethics • Advanced Food Technology • Industrial Safety & Management • Advanced Animal & Plant Cell Technology	3	-	-	3	
MTB320	Immunology & Immunotechnology Lab	-	-	4	2	
MTB321	Enzymology & Enzyme Technology Lab	-	-	2	1	
MTB360	Summer Project (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP341	Advanced Communication - III	30	-	-		
BSP343	Behavioural Science - III	30	-	-		
 FLP344 FLP345 FLP346 FLP347 FLP348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
MTB460	Project (20-22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **MTB 101** **Credit Units: 04**

Course Objective:

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

Course Contents:

Module I
Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II
Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III: Modes of Regulation
Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways
Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation, Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Biochemistry by A. Lehninger revised by Nelson and Cox.
- Biochemistry by Mathews, Van Holde and Ahern. IIIrd Edition.

References:
- “Biochemistry” by White, Handler and R.B. Smith 7th Ed. 1983
- Biochemistry” by L.Stryer Third Edition.
- Biochemistry by Voet and Voet.
- Fundamentals of Biochemistry by Conn and Stumph.

ADVANCED MICROBIAL TECHNOLOGY

Course Code: **MTB 102** **Credit Units: 04**

Course Objective:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

Course Contents:

Module I

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

Module II

Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module III

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

Module IV

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

Module V

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill.
- Microbiology by Prescott.

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: **MTB 103** **Credit Units: 04**

Course Objective:
To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Course Contents:

Module I: Ultracentrifugation
Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

Module II: Gel electrophoresis
Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

Module III
TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

Module IV
UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.

Module V
Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Module VI
Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:
- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John Wiley and Sons Ltd.
- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

BIOINFORMATICS

Course Code: **MTB 104** **Credit Units: 04**

Course Objective:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Course Contents:

Module I: Introduction and overview

The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.

Module II

Exact string matching -classical comparison based methods, semi numerical string matching, suffix trees - construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison

Module III

Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.

Module IV

Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees , estimating the rate of change, likelihood and trees; analysis software.

Module V

Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformaticsby C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MTB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

BIOCHEMISTRY LAB

Course Code: **MTB 120** **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity

Module II: Nucleic Acid
Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel.
Carbohydrate: Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar
Lipids: Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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MICROBIOLOGY LAB

Course Code: **MTB 121** **Credit Units: 01**

Course Contents:

Module I
Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

Module II
Biochemical test – Indole test, methyl red test, voges proskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: MTB 122 Credit Units: 01

Course Objective:

To demonstrate the techniques used in the biotechnology for purification, characterization and identification of the proteins and other biotechnologically important products

Course Contents:

Module I: Cell disruption techniques

homogenization, sonication

Module II

Centrifugation – low speed and high speed.

Module III: Spectrophotometer techniques

Visible and UV spectrophotometry

Module IV

Chromatography-ion exchange, gel filtration and affinity columns, fraction collection, monitoring UV absorbance. Applications in enzyme purification.

Module V

Techniques for removal of salt/solvent from a sample -desalting, dialysis, ultrafiltration, speedvac, lyophilization etc.

Module VI

Electrophoresis –1 D (Polyacryamide gel electrophoresis and agarose) and 2D. Isoelectric focusing.

Module VII

Polarization and fluorescence microscopy

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOINFORMATICS LAB

Course Code: MTB 123 Credit Units: 01

Course Objective:

To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

Course Contents:

Module I

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein

Module II

Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm

Module III

Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing

Module IV

Phylogenetic prediction and analysis

Module V

Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.

Module VI

Finding transcription regulatory signals

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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ADVANCED COMMUNICATION

Course Code: **MTB 141** **Credit Units: 01**

Course Objective:

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: MTB 143 Credit Units: 01

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MTB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1 : Découvrir la langue française : (oral et écrit)

7. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
8. dire/interroger si on comprend
9. Nommer les choses

Unité 2: Faire connaissance

5. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
6. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

15. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
16. article indéfini, défini, contracté
17. nom, adjectif, masculin, féminin, singulier et pluriel
18. négation avec « de », "moi aussi", "moi non plus"
19. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
20. pronom tonique/disjoint- pour insister après une préposition
21. futur proche

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

CELL AND MOLECULAR BIOLOGY

Course Code: **MTB 201** **Credit Units: 04**

Course Objective:

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

Course Contents:

Module I

Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.

Module II

Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.

Module III

Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.

Module IV: Replication

Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease.

Recombination & Repair: Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.

Module V

Transcription - RNA transcription and the proteins required for each step, maturation of the RNA transcript derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression

Module VI: Translation

Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Molecular Cell Biology by Bruce Albert
- Molecular Biology by Lodish Darnell and Baltimore
- Molecular Biology of the gene by Watson et al 4th ed.

References:

- Genes VIII by Benjamin Lewis
- Genetics by Ursula Goodenough
- Cytogenetics by l Garl P. Swanson, Mertz & Young
- Biochemistry by Stryer
- Genome by T.A. Brown, John Willey and Sons Inc.

RECOMBINANT DNA TECHNOLOGY

Course Code: **MTB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I

Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

Module II: Gene isolation

Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

Module III: Heterologous gene expression (bacteria and yeast)

Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

Module IV: Studying gene regulation and control

In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

Module V: Automation and robotic advances in RDT

DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation

Module VI: Laboratory, industrial and environmental applications of RDT

High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- "Gene Expression Technology" by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- "DNA Cloning: A Practical Approach" by D.M. Glover and B.D. Hames, IRL Press.

BIOPROCESS TECHNOLOGY

Course Code: **MTB 203** **Credit Units: 04**

Course Objective:

The present course aims to aware about the requirements for large-scale cultivation of microbes for production of industrially important products with purification and characterization of these bioproducts using different techniques

Course Contents:

Module I

Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch.

Module II

Substrates for bioconversion processes and design of media, sterilization; Cell culture techniques; Inoculum development and aseptic transfers. Bioreactors – CSTR, CSTR in series , tower, loops, airlift bubble column & packed bed. Different types of pumps, valves, and line materials, piping convections etc. used in Biochemical Processes

Module III

Process technology for the production of primary metabolites, e.g. Baker's yeast, ethanol, citric acid, amino acids (lysine and glutamic acid). Microbial production of industrial enzymes (glucose isomerase, cellulase, amylase, lipase, protease) and secondary metabolites (penicillins, cephalosporins and streptomycin). Biomass (SCP and mushroom) production from agro-residues.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition , uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery , uses of various forms etc.

Streptomycin – chemical structure, production, harvest and recovery, use, by-product of streptomycin fermentation etc.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Glutamic Acid: Direct Fermentation, contribution of feed back control and regulation of cell permeability barrier for production.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Module IV

Characteristics of bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press.
- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
- Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, W.F. Veith, John Wiley and Sons Inc.
- Biochemical Engineering, S. Aiba, A.E. Humphrey and N.F. Millis, University of Tokyo Press.
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Process Engineering in Biotechnology, A.T. Jackson, Prentice Hall.
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering/ Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society.

GENOMICS AND PROTEOMICS

Course Code: **MTB 204** **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

GENOMICS

Module I: Introduction to Genomics
Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes
Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods.

Module III
Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module IV
Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.

Module V
Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.

Module VI
Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA : Structure and Function, Richard R. Sinden
- www.panimaText.com

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MTB 205** **Credit Units: 03**

Course Objective:

The main objectives are to cover representative pharmaceutical dosage forms, and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

Course Contents:

Module I
Introduction to Physical Pharmaceutics - Metrology and Calculations,

Module II
Molecular structure, properties and States of Matter, Solutions, Phase Equilibra, Micromeritic and Powder Rheology, Surface and Interfacial Phenomena, Dispersion Systems, Diffusion & Dissolution, Kinetics and drug stability, Viscosity & Rheology

Module III
Polymer Science and Applications, Formulations and Development, Packaging

Module IV
Introduction to Industrial Processing, Transport Phenomena (Fluid Flow, Heat Transfer and Mass Transfer)

Module V
Particulate Technology (Particle Size, Size reduction, Size Separation, Powder Flow and Compaction), Unit Operations (Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, and Drying)

Module VI
Materials of Pharmaceutical Plant Construction, Good Manufacturing Practice (GMP's) Guidelines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Bentley's Pharmaceutics by E A Rawlins
- Pharmaceutical Sciences by Remington

References:
- Physical Pharmacy by Alfred Martin.
- Cooper and Gunn's Tutorial Pharmacy

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MTB 206** **Credit Units: 03**

Course Objective:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I

Environmental components, Natural resources, Ecosystem and its diversity, Environmental pollution and its major impacts, Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Land degradation, Biomagnification

Module II

Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III

Biodegradation and bioremediation of major pollutants, Biomineralisation: Use of microbial technology for mining

Module IV

Waste water engineering: Treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V

Bioassessment of environmental quality: Biosensors and biomarkers, Biofertilizers, Biopesticides and Vermi composting

Module VI

Environmental impact assessment and Environmental audit, Related case studies from Indian market

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

BIOSENSORS

Course Code: **MTB 207** **Credit Units: 03**

Course Objective:

On completion of the module students should Be able to Appreciate the basic configuration and distinction among biosensor systems, To gain an understanding of general biosensor principles and terms, To be able to design, model, simulate, fabricate, and test a biosensor, To gain an overall knowledge of biosensor types, applications, requirements, and capabilities to allow improved interaction with physicians, clinicians, and biomedical engineers, and to enable the student to conduct biomedical engineering research.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and transducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Affinity Biosensors: Techniques and Protocol by K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applications by V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors by B.R. Eggins, John Wiley and Sons Inc.

References:

- Sensors and Sensing in Biology and Engineering by F.G. Barth, wt al, Springer Verlag.
- Biosensors by Minh Canh. Tran
- Biosensors: Theory and Applications by Donald G. Buerk
- Enzyme and Microbial Biosensors: : Techniques and Protocols - by Kim R. Rogers, Ashok Mulchandani
- Biosensors in Environmental Monitoring - by Ursula Bilitewski, Anthony P. F. Turner.
- Biosensors: Micro electrochemical Devices - by Marc J. C. Lambrechts
- Biosensors with Fiberoptics - by Donald Lee Wise, Lemuel B. Wingard
- Biosensors and Their Applications - by That Tjien Ngo, Victor Chi-Min Yang
- Thermal Biosensors, Bioactivity, Bioaffinity -by Prakash K. Bhatia
- Novel Approaches in Biosensors and Rapid Diagnostic Assays - by Zvi Liron, Avraham Bromberg, Morly Fisher
- Biosensors - by Anthony E. G. Cass.

ARTIFICIAL NEURAL NETWORKS

Course Code: **MTB 208** **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, besides the closely related aspects of artificial neural networks.

Course Contents:

Module I
Historical background, Why is learning hard?

Module II
Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multilayer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning.

Module III
The back propagation algorithm, Aspects of Learning Theory and Generalization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?.

Module IV
Neural networks and analog VLSI, Selected Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Neural Networks: A Comprehensive Foundation by S. Haykin, Prentice Hall.

References:

- Neutral Networks for Pattern Recognition by C. Bishop, Oxford University Press.

AGRICULTURE BIOTECHNOLOGY

Course Code: **MTB 209** **Credit Units: 03**

Course Objective:

This course is designed to cover key concepts in the structure and manipulation of DNA and inheritance of genes, traditional plant breeding, current impact of biotechnology on crop production and its commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation.

Course Contents:

Module I
Sterilization; Nutrient medium; Callus & Suspension culture; canning, regulation; Micropropagation, production of virus free plants, anther culture, pollen culture; ovary culture, homozygous lines; meristem culture; somatic hybridization, somaclonal variation, germplasm conservation

Module II
Genetic engineering in plants, direct and indirect method of plant cell transformation, vectors with special reference to Ti plasmids, selectable markers, mechanism of T-DNA transfer to plants, transgenic plants, molecular maps and gene tagging, marker assisted selection

Module III
Applications of genetic engineering, insect and pest resistance, herbicide resistance, cytoplasmic male sterility in plants, molecular farming.

Module IV
Plant patents, plant variety certificates, safety regulation in transgenic plants.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

FUNDAMENTALS OF COMPUTERS AND PROGRAMMING IN ‘C’

Course Code: **MTB 210** **Credit Units: 03**

Course Objective:

The main objectives of the course are to demonstrate familiarity with computer, show understanding of computer hardware and software, display basic understanding of computer programming processes, develop understanding of computer file management and protection principles, explain Internet, LAN and digital media fundamentals, define information systems analysis and design concepts, identify and demonstrate use of database concepts.

Course Contents:

Module I
Introduction to Digital Computer: Major components of a Digital Computer - Number system - Binary codes - Fixed and Floating Point representation - Logic gates - Flip flops - Registers - Input and Output Devices.

Module II: Introduction to programming
Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program.

Module III: Data Types
Variables - Constants - Arithmetic expressions - Use of operators - program examples.

Module IV: Decision making in C
Relational operators - Logical operators - Precedence of operators - IF and IF ... ELSE statements – Looping concepts in C _ WHILE loop - DO ... WHILE and FOR loops - Programming examples.
Functions: User defined Functions - Local and Global variables - Parameters - Programming examples.

Module V: Arrays
BREAK statement - Strings and character arrays - examples.
Pointers: Concept of Pointers - The Indirection operator - Use of Pointers in arrays - Programming examples.

Module VI: Structures
The period operator - Arrays of structures - Arrays within structures - Structures within structures - Pointers to structures - The arrow operator - Programming examples.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamentals of Computers by V. Rajaraman
- C Programming" by G. Kochan

References:
- Computer Fundamentals by B. Ram.
- The Spirit of C" by Mullish Cooper.

BIO-ENERGY ENGINEERING

Course Code: **MTB 211** **Credit Units: 03**

Course Objective:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling.

Course Contents:

Module I: Biomass Sources, Characteristics & Preparation

Biomass Sources and Classification. – Chemical composition and properties of different biomass materials and bio-fuels – Sugar cane molasses and other sources for fermentation ethanol-Sources and processing of oils and fats for liquid fuels- Energy plantations

-Preparation of woody biomass: Size reduction, Briquetting of loose biomass, Drying, Storage and Handling of Biomass.

Module II: Biogas, Technology

Feedstock for biogas production, Aqueous wastes containing biodegradable organic matter, animal residues-. Microbial and biochemical aspects- Operating parameters for biogas production Kinetics and mechanism - Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.

Module III: Bio-Ethanol and Bio-Diesel Technology

Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

Module IV: Pyrolysis and Gasification of Biomass

Thermo-chemical conversion of ligno-cellulose biomass – Biomass processing for liquid fuel production - Pyrolysis of biomass-Pyrolysis regime, effect of particle size, temperature, and products obtained.

Thermo-chemical gasification principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidized Bed Gasifiers.

Module V: Combustion of Biomass and Cogeneration Systems

Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Fuels from Biomass and Wastes by D.L. Klass and G.M. Emert, Ann Arbor Science pub. Inc. Michigan,
- Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes by A. Chakraverthy, Oxford & IBH publishing Co., New Delhi,

References:

- Biogas Systems: Principles and Applications by K.M. Mital, New Age International Publishers (p) Ltd.,
- Biomass Energy Systems, by P. Venkata Ramana and S.N. Srinivas, Tata Energy Research Institute, New Delhi, 1996.
- Bio-gas Technology by Khandelwal K.C. and Mahdi, Tata McGraw-Hill pub. Co. Ltd., New Delhi
- Advances in bio-gas Technology by O.P. Chawla, I.C.A.R., New Delhi. 1970.

CELL AND MOLECULAR BIOLOGY LAB

Course Code: **MTB 220** **Credit Units: 02**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

15. Isolation of genomic DNA from prokaryotic and Eukaryotes
16. Isolation of plasmid.
17. Study of apoptosis by TUNEL method
18. Isolation of cell organelles by ultracentrifugation.
19. Study of in vitro transcription.
20. Study of DNA repair mechanism
21. Site-directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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RECOMBINANT DNA TECHNOLOGY LAB

Course Code: **MTB 221** **Credit Units: 02**

Course Contents:

15. Preparation and Transformation of competent cells by CaCl2 method.
16. Restriction digestion
17. Legation
18. Southern hybridization
19. Western blotting
20. RFLP
21. PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOPROCESS TECHNOLOGY LAB

Course Code: **MTB 222** **Credit Units: 02**

Course Objective:
The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:
Module I
Isolation of industrially important micro organisms for microbial processes.
Module II
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.
Module III
Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)
Module IV
Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

GENOMICS AND PROTEOMICS LAB

Course Code: **MTB 223** **Credit Units: 01**

Course Objective:
The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:
Module I
Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins
Module II
DNA sequencing methods, gene finding tools and Genome annotation
Module III
Comparison of two given genomes, Analysis of 2D – IEF data
Module IV
Micro array and Micro array data analysis, Inference of protein function from structure

Module V
Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MTB 241** **Credit Units: 01**

Course Objective:
To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: **MTB 243** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MTB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

7. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
8. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
9. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

9. situer un lieu
10. s'orienter, s'informer sur un itinéraire.
11. Chercher, décrire un logement
12. connaître les rythmes de la vie

Unité 5: s'informer

9. demander/donner des informations sur un emploi du temps passé.
10. donner une explication, exprimer le doute ou la certitude.
11. découvrir les relations entre les mots
12. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
12. Adjectifs possessifs/exprimer la possession à l'aide de :
    i. « de » ii. A+nom/pronom disjoint
13. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
14. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
15. passé composé
16. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: **MTB 301** **Credit Units: 04**

Course Objective:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I
Phylogeny of Immune System, Types of immunity clonal nature of immune response. Organization and structure of lymphoid organs. Antibody structure and function. Major histocompatibilty: Complex BCR and TCR, generation of antibody diversity, Complement system

Module II: Cells of the immune system
Hematopoiesis and differentiation, antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance.

Module III
Cell mediated toxicity, Hypersensitivity, Autoimmunity, Vaccines: General considerations, ideotype network hypothesis

Module IV
Tumor immunology, Transplantation immunology, Immunotheropy.

Module V
Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, (FACS) Hybridoma technology and its application

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Immunology by J. Kubey Fence Creek Publishing (Blackwell).
- Immunology by Ivan Riott

References:
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: **MTB 302** **Credit Units: 04**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
General characteristics of enzymes, Mechanism of action of few enzymes: lysozyme, ribozymes, chymotrypsin and alcohol dehydrogenase.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Multisubstrate systems, Enzyme Inhibitors as therapeutic agents, active site, Isozyme and multienzyme complex.

Module III: Applications of enzymes
Clinical and Industrial, Enzyme Immobilization and its applications.

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice of reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies, Thermostable enzymes with special references to amylases, lipases and proteases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems by I.H. Segel, Wiley-Interscience
- Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis by R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis by R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer
- Industrial Enzymes & their applications by H. Uhlig, John Wiley and Sons Inc.

DRUG DESIGN AND DEVELOPMENT

Course Code: **MTB 303** **Credit Units: 04**

Course Objective:

The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research by J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action" by W.B. Pratt and P. Taylor, Churchill Livingston.

References:

- Principles of Medicinal Chemistry" by W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins.
- Side Effects and Drug Desig by E.J. Lien, Marcel Dekker
- The Anticancer Drugs by W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.

BIOPROCESS PLANT DESIGN

Course Code: **MTB 304** **Credit Units: 03**

Course Objective:

The objective of this paper is to include the application of chemical engineering principles/unit operations to bioprocess systems and the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I
Introduction; general design information; Mass and energy balance.

Module II
Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment.

Module III
Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment.

Module IV
Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries.

Module V
Design of facilities for cleaning of process equipment used in biochemical industries.

Module VI
Utilities of biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Applied Process Design for Chemical and Petrochemical Plants by E.E. Ludwig, Butterworth-Heinemann.
- Chemical Engineering by R.K. Sinnott, J.M. Coulson and J.F. Richardson, Butterworth-Heinemann.

References:
- Chemical Engineers Handbook by R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling by F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers by M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design by E. Bausbacher and R. Hunt, Prentice Hall PTR.

POLLUTION PREVENTION FUNDAMENTALS

Course Code: **MTB 305** **Credit Units: 03**

Course Objective:

To develop an understanding of the methods and impacts of waste minimization including waste pollution prevention and recycling, obtain an overview of relevant environmental laws and regulations governing waste management, understand the phenomena and environmental impact of green-house gases and alternative energy sources to reduce the effect of global warming.

Course Contents:

Module I: Pollution Prevention in Industries
Environment friendly chemical processes-Properties and fates of environmental contaminants- Regulations for clean environment and implications for industries – Improved Manufacturing Operations.

Module II: Life Cycle Assessment and Environmental Audit
Life cycle assessment and pollution prevention economics-Hazard and risk Analysis - Pollution prevention planning - Design for the environment.

Module III: Conservation of Materials and Energy
Water energy and reagent conservation – Residuals management –
Economic Recovery and Recycling of Wastes - Case studies.

Module IV: Total Quality Environment Management and Ems 14000
Municipal pollution prevention programmes –Environment Management System-14000- Systematic, Structured and Documented Response to Environmental Issues- Auditable and Time Targeted Environmental Improvement Programs.

Module V: Hierarchy of Environment Management Practices
Waste-specific pollution prevention: waste pre - generation focus on minimization / recycling, Waste-specific pollution control treatment: pre – generation focus on disposal/ recycling- Waste-specific Post-release-to environment focus: recycling/ remediation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pollution Prevention: Fundamentals and Practice by Bishop P., McGraw-Hill International Edition, McGraw-Hill book Co, Singapore
- Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner,, Oxford University Press. N.Y.

References:

- Chemical Technology for better Environment by T.K. Roy, (Editor), Allied publishers Ltd, Chennai
- Pollution Prevention through Process Integration: Systematic Design Tools by El Halwagy, M.M, Academic Press, N.Y.

DRUG DELIVERY SYSTEMS

Course Code: MTB 306 Credit Units: 03

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MTB 307** **Credit Units: 03**

Course Objective:

The objectives of the course are to explain the fundamental principles of IPR issues and examine information policy issues from different perspectives. Students will study and assess policy groups, intellectual property rights, access to information and research policy issues that usually include plant, animal and microbial genetic engineering products

Course Contents:

Module I
Objectives of Intellectual Property Rights, origin and evolution of IPR, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Patent, Industrial Design, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties

Module II: IPR
National and international perspective, TRIPS and WIPO

Module III: Patent
Basic criterion for patentability, patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and international perspective, Case study: Basmati case, Neem controversy, Turmeric Case

Module IV: Biosafety
Definition and requirement; biosafety in relation to human health, environment, transgenic research and applications, biosafety laws, guidelines and conventions, biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule ; Regulation bodies at National and International level

Module V
Legal and socioeco'nomic impact of the products and techniques in Biotechnology, Bioethics in plant, animal and microbial genetic engineering, Ethical issues in healthcare, Biopiracy and ethical conflicts

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Coyles information highway handbook; A Practical File on the New Information Order, American Library Association, 2000.
- American Indian Cultural & Research Journal *(UCLA)*

References:

- Refer to Periodicals, Industry directories, Articles and report in journals on the regulatory issues, "Biotechnology" series by Rehm & Reed.

ADVANCED FOOD TECHNOLOGY

Course Code: **MTB 308** **Credit Units: 03**

Course Objective:

The purpose of the Food Technology major is to produce professionals with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research

Course Contents:

Module I
Processing and preservation technologies used in the food industry: heating, drying and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies

Module II
Micro-organisms and their metabolites for food, feed and fuel, development and application of food enzymes: fungal amylases, alpha-amylase, pectinase, amyloglucosidase and catalase. Technology for improvement of the quality of fruit juice through enzymatic treatment, Food spoilage and food poisoning micro-organisms

Module III
Pre- and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage

Module IV
Development of environment-friendly packaging materials based on product characteristics and performance properties of packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminium containers, and retortable pouches based on heat penetration studies and sterilization value

Module V
Food Safety in food service Establishment and other food areas

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Food Technology by Fraziar
- Food Microbiology, 2nd edition by Adams and Moss.

References:
- Evaluation Of Certain Food Additives And Contaminants, (WHO Technical Report Series 901) World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland
- International Journal of Food Science & Technology, Blackwell synergy publication
- Bioterrorism and Food Safety by Rasco and Bledsoe.

INDUSTRIAL SAFETY AND MANAGEMENT

Course Code: **MTB 309** **Credit Units: 03**

Course Objective:

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Course Contents:

Module I: Hazards
Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

Module II: Psychology and Hygiene
Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control
Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management
Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

Module V: Laws
Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S .Wood Wiley Interscience,

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

ADVANCED ANIMAL AND PLANT CELL TECHNOLOGY

Course Code: **MTB 310** **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

ADVANCED ANIMAL CELL TECHNOLOGY

Module I
Brief history of animal cell and organ culture, Cultivation of animal cell *en masse* in bioreactor, methods for scale-up, immobilized cell culture, insect cell culture, somatic cell culture, organ culture, and embryo culture.

Module II
Valuable products from cell culture, Production of recombinant tissue-plasminogen-activator, blood factor VIII, erythropoietin, insulin, somatostatin, somatotropin.

Module III
Hybridoma technology, Monoclonal antibodies- production and application, Stem cell technology, custom made animals and tissue engineering

ADVANCED PLANT CELL TECHNOLOGY

Module IV
Brief introduction to various tissue culture techniques,
Cell Cultures, regeneration and preservation: Plant regeneration through meristem, callus (somatic embryogenesis) and anthers. Protoplast culture and somatic hybridization. Production, preservation and use of somatic embryos. Artificial Seeds and Cybrids.

Module V
Induction & utilization of somatic variants; Secondary metabolite production through cell cultures. Principles and the technology, pharmaceutical, secondary metabolites & beverage production; Commercialization of tissue culture technology (Micropropagation). Plant cell reactors. Immobilized plant cell reactors

Module VI
Engineering of Chloroplast and mitochondrial genomes and their applications, Biotransformation by plant cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

References:
- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: **MTB 320** **Credit Units: 02**

Course Objective:

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

Course Contents:

Module I

Blood film preparation and identification of cells, Identification of blood group, Isolation of serum.

Module II

Lymphoid organs and their microscopic organization.

Module III

WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test, ELISA:- DOT, SANDWICH

Module IV

Purification of IgG through affinity chromatography

Module V

Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code: **MTB 321** **Credit Units: 01**

Course Objective:

To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells

Course Contents:

Module I

Isolation of Enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, acid phosphatase, cellulase, protease.

Module III

Production of enzyme on industrial scale using solid and liquid-state fermentation.

Module IV

Purification of enzyme by ammonium sulphate fractionation, ion-exchange, gel permeation chromatography.

Module V

Enzyme Kinetics: Determination of Michaelis-Menten constant (Km) and Maximum Velocity (Vmax), Temperature optima and pH optima of an enzyme.

Module VI

Enzyme immobilization and its effect on enzyme activity

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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PROFESSIONAL COMMUNICATIONAL SKILLS

Course Code: **MTB 341** **Credit Units: 01**

Course Objective:

To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

Course Contents:

Module I: Mechanics and Semantics of Sentences
Writing effective sentences
Style and Structure

Module II: Developing writing skills
Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

Module III: Business Presentations
Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

LEADING THROUGH TEAMS

Course Code: **MTB 343** **Credit Units: 01**

Course Objective:

This course aims to enable students to:
Understand the concept and building of teams
Manage conflict and stress within team
Facilitate better team management and organizational effectiveness through universal human values.

Course Contents:

Module I: Teams: An Overview
Team Design Features: team vs. group
Effective Team Mission and Vision
Life Cycle of a Project Team
Rationale of a Team, Goal Analysis and Team Roles

Module II: Team & Sociometry
Patterns of Interaction in a Team
Sociometry: Method of studying attractions and repulsions in groups
Construction of sociogram for studying interpersonal relations in a Team

Module III: Team Building
Types and Development of Team Building
Stages of team growth
Team performance curve
Profiling your Team: Internal & External Dynamics
Team Strategies for organizational vision
Team communication

Module IV: Team Leadership & Conflict Management
Leadership styles in organizations
Self Authorized team leadership
Causes of team conflict
Conflict management strategies
Stress and Coping in teams

Module V: Global Teams and Universal Values
Management by values
Pragmatic spirituality in life and organization
Building global teams through universal human values
Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - III

Course Code: **MTB 344** **Credit Units: 02**

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

7. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
8. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
9. parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

7. maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
8. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
9. caractériser une personne (aspect physique et caractère)

Contenu grammatical:

21. accord des adjectifs qualificatifs
22. articles partitifs
23. Négations avec de, ne…rien/personne/plus
24. Questions avec combien, quel…
25. expressions de la quantité
26. ne…plus/toujours - encore
27. pronoms compléments directs et indirects
28. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
29. Impératif avec un pronom complément direct ou indirect
30. construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

SUMMER PROJECT

Course Code: MTB 360 Credit Units: 12

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

PROJECT

Course Code: MTB 460 Credit Units: 30

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(xi) Long Tables
(xii) Long quotations
(xiii) Foot notes
(xiv) Multilane captions
(xv) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor’s Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar’s signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[11] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[12] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[13] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[14] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[15] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[13] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[14] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[15] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Assessment Scheme:

Continuous Evaluation: 40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Bachelor of Technology (Biotechnology)

Programme Code: BTB

Duration – 4 Years Full Time

Programme Structure

And
Curriculum & Scheme of Examination

Batch: 2021 – 2025

AMITY UNIVERSITY
MAHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2019

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses						
BTB 101	Applied Mathematics - I	3	1	-	4	
CHE 101	Applied Chemistry	3	1	-	4	
CSE 104	Programming for Problem Solving	2	1	-	3	C 05.03.2020
BTB 105	Life Sciences-I	2	1	-	3	
CHE 121	Applied Chemistry Lab	-	-	2	1	
CSE 124	Programming for Problem Solving Lab	-	-	4	2	C 05.03.2020
BTB 123	Engineering Graphics Lab	-	-	2	1	
EVS 142	Environmental Studies - I	2	-	-	2	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three						
BCU 141	Communication Skill - I	30	-	-		
BSU 143	Behavioural Science - I	30	-	-		
	Foreign Language - I	30	-	-		
FLU 144	French - I					
FLU 145	German					
FLU 146	Spanish					
FLU 147	Japanese					
FLU 148	Chinese					

SECOND SEMESTER

Compulsory Courses						
BTB 201	Applied Mathematics – II	3	1	-	4	
PHY 101	Applied Physics - I	3	1	-	4	
CSE 204	Object Oriented Programming Using C++	2	1	-	3	C 05.03.2020
ECE 101	Basic Electrical Engineering	3	-	-	3	
BTB 206	Life Science-II	3	-	-	3	
PHY 121	Applied Physics Lab – I	-	-	2	1	
CSE 224	Object Oriented Programming Using C++ Lab	-	-	2	1	C 05.03.2020
ECE 121	Basic Electrical Engineering Lab	-	-	2	1	
EVS 242	Environmental Studies - II	2			2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)						
BCU 241	Communication Skill - II	30	-	-		
BSU 243	Behavioural Science - II	30	-	-		
	Foreign Language - II	30	-	-		
FLU 244	French - II					
FLU 245	German					
FLU 246	Spanish					
FLU 247	Japanese					
FLU 248	Chinese					

V. dastar

TERM PAPER DURING SUMMER BREAK

THIRD SEMESTER

Compulsosry Courses						
BTB301	Cell Biology	3	-	-	3	
BTB302	Biochemistry - I	3	-	-	3	
BTB303	Microbiology	3	1	-	4	
BTB304	Molecular Biology	3	-	-	4	
CSE 202	Data StructuresThrough C++	3	-	-	3	C 05.03.2020
BTB320	Cell Biology Lab	-	-	2	1	
BTB321	Biochemistry Lab - I	-	-	2	1	
BTB322	Microbiology Lab	-	-	2	1	
BTB323	Molecular Biology Lab	-	-	2	1	
CSE 222	Data Structures Through C++ Lab	-	-	2	1	C 05.03.2020
BTB330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three						
BCU341	Communication Skill - III	30	-	-		
BSU 343	Behavioural Science - III	30	-	-		
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses						
BTB401	Biochemistry – II	3	1	-	4	
BTB402	Genetics	3	1	-	4	
BTB403	Methods & Instrumentation in Biotechnology	3	-	-	3	
BTB404	Chemical Biology	2	1	-	3	
CSE 403	Java Programming **(V to IV)**	3	-	-	3	C 05.03.2020
BTB420	Biochemistry Lab - II	-	-	2	1	
BTB421	Genetics Lab	-	-	2	1	
BTB422	Methods & Instrumentation in Biotechnology Lab	-	-	2	1	
CSE 423	Java Programming Lab **(V to IV)**	-	-	4	2	C 05.03.2020
	TOTAL				21	
Optional Courses - Value Added Courses; Any Three						
BCU 441	Communication Skill - IV	1	-	-	1	
BSU 443	Behavioural Science - IV	1	-	-	1	
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	2	-	-	2	

SUMMER PROJECT I – (6 - 8 WEEKS)

FIFTH SEMESTER

Compulsory Courses						
BTB501	Plant Biotechnology	3	-	-	3	
BTB502	Animal Biotechnology	3	-	-	3	
BTB503	Structural Biology	3	-	-	3	
BTB504	Chemical Engineering Principles	3	-	-	3	
BTB505	Basic Bioanalytical Techniques	3	-	-	3	
CSE510	Advanced Programmimg through Python **(New)**	3	-	-	3	C 05.03.2020
BTB520	Plant Biotechnology Lab	-	-	2	1	
BTB521	Animal Biotechnology Lab	-	-	2	1	
BTB522	Structural Biology Lab	-	-	2	1	
CSE530	Advanced Programmimg through Python Lab **(New)**	-	-	2	1	C 05.03.2020
BTB560	Summer Project – I (Evaluation)	-	-	-	5	
	TOTAL				**27**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)						
BCU 541	Communication Skill - V	30	-	-		
BSU 543	Behavioural Science - V	30	-	-		
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses						
BTB601	Recombinant DNA Technology	3	-	-	3	
BTB602	Enzymology & Enzyme Technology	3	-	-	3	
BTB603	Immunology & Immunotechnology	3	1	-	4	
BTB604	Computational Biology	3	-	-	3	
BTB605	Fundamentals of Biochemical Engineering	3	-	-	3	
BTB620	Recombinant DNA Technology Lab	-	-	2	1	
BTB621	Enzymology & Enzyme Technology Lab	-	-	2	1	
BTB622	Immunology & Immunotechnolgy Lab	-	-	2	1	
BTB623	Computational Biology Lab	-	-	2	1	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)						
BCU 641	Communication Skill - VI	30	-	-		
BSU 643	Behavioural Science - VI	30	-	-		
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT - II – (6 - 8 WEEKS)

SEVENTH SEMESTER

Compulsory Courses						
BTB701	Bioprocess Technology	3	-	-	3	
BTB702	Downstream Processing	3	-	-	3	
BTB703	Statistics for Biology	3	-	-	3	
 BTB704 BTB705 BTB706 BTB707 BTB708 BTB709 BTB710	**Elective (Anyone of the following 8)** . Biosensors • Thermodynamics of Biological Systems • Pharmaceutical Chemistry & Drug Design • Current Topics in Biotechnology • Environmental Biotechnology • Bioprocess Plant Design • Artificial Neural Networks	3	-	-	3	
CSE 710	Relational Database Management System **(New)**	3	-	-	3	C 05.03.2020
BTB720	Bioprocess Technology Lab	-	-	2	1	
BTB721	Downstream Processing Lab	-	-	2	1	
CSE 730	Relational Database Management System Lab **(New)**	-	-	2	1	C 05.03.2020
BTB760	Summer Project - II (Evaluation)	-	-	-	6	
	TOTAL				**24**	

EIGHTH SEMESTER

Compulsory Courses						
BTB801	Genomic & Proteomics	3	1	-	4	
BTB802	Drug Delivery Systems	3	-	-	3	
BCH 621	Management, Accounting & Cost Control	1	-	-	1	
BCH 622	Project Management	1	-	-	1	
BCH 623	Principles of Management & Enterprenurship Development	1	-	-	1	
CSE 804	ASP.NET	3	-	-	3	
BTB820	Genomic & Proteomics Lab	-	-	2	1	
CSE 824	ASP.NET	-	-	2	1	
BTB860	Major Project (10-12 Weeks)	-	-	-	16	
	TOTAL				**31**	

Curriculum & Scheme of Examination

APPLIED MATHEMATICS – I

Course Code: BTB 101 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Differential Calculus

Derivative of a function, Derivatives at a point, Fundamental rules for differentiation: Product Rule, Quotient Rule and Chain Rule, Differentiation of Implicit Functions, Parametric forms and Logarithmic Differentiation, Successive differentiation, Leibnitz's theorem (without proof), Mean value theorem, Taylor's and Maclaurin's Theorem, Asymptote & Curvature, Partial Differentiation, Euler's Theorem, Maxima and Minima

Module II: Integral Calculus

Fundamental Integral Formulae, Methods of Integration: Integration by Substitution, By Parts, Partial Fractions, Definite Integral and its Properties, Reduction Formulae, Application to length, Area and Volume.

Module III: Ordinary Differential Equations

Definition of Order and Degree of differential equation, Formation of ODEs, Solution of Differential Equation of 1st Order and 1st Degree: Variable Separation, Homogeneous Differential Equations, Linear Differential Equations, Exact Differential Equations, General Linear ODE of Second Order, Solution of Homogeneous Equation, Solution of Simple Simultaneous ODE

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Differential Calculus by Shanti Narain
- Integral Calculus by Shanti Narain

References:

- Differential Equation by A.R.Forsyth
- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - I (FIELDS AND WAVES)

Course Code: BTB 102 **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I: Electrostatics
Brief introduction of Vectors, gradient of a scalar field, divergence and curl of vector field, Electric flux, Gauss's law, Statements of Gauss divergence and Stokes theorem

Module II: Relativity
Michelson-Morley experiment, Inertial & non-inertial frames, Special theory of Relativity, Relativistic space-time transformation, Transformation of velocity, Variation of mass with velocity, Mass-energy equivalence

Module III: Oscillations & Waves
Simple harmonic motion – equation and energy conservation, superposition of two SHMs, Lissajous figures, damped and forced oscillations – equations, amplitude and frequency response, LCR Circuit, resonance, sharpness of resonance, equation of motion for plane progressive waves, superposition of waves

Module IV: Wave Nature of Light
Interference: Conditions of interference, division of wavefront, Fresnel's biprism, division of amplitude, interference due to thin films, Newton's rings
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, Transmission grating and its resolving power.
Polarization: Birefringence, Nicol prism, Production and analysis of plane, circularly and elliptically polarized light, Half and quarter wave plates, Optical rotation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Waves & oscillation, A. P. French
- Physics of waves, W. C. Elmore & M. A. Heald
- Introduction to Electrodynamics, D. J. Griffith
- Electrodynamics, Gupta, Kumar & Singh
- Optics, A. K. Ghatak
- Engineering Physics, Satya Prakash

APPLIED CHEMISTRY- I

Course Code: BTB 103 Credit Units: 03

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Chemical Bonding
Types of bond: Ionic, Covalent and Co-ordinate bond; Fajan's rule; Hybridisation; H- bonding ; Valence bond and Molecular orbital theory for diatomic molecule.

Module II: Organic Mechanism
Electronegativity and dipole moment; Electron Displacement Effects: Inductive Effect; Mesomeric Effect; Electromeric Effects; Fission of covalent bonds; Intermediates of Organic reactions; Carbonium, Carbanion, Free Radical and Carbene; Types of organic reactions; Substitution, Elimination, Addition.

Module III: Instrumental method for Analysis
Introduction; Principles of spectroscopy; Law's of Absorbance; IR: Principle Instrumentation; Application; UV: Principle, Instrumentation and Application; NMR Principle and Instrumentation; Application; Chromatography; GC: Principle, Instrumentation and Application; HPLC: Principle, Instrumentation and Application.

Module IV: Thermodynamics
Introduction; Terminology; First Law; Heat Capacity; Calculation of thermodynamic quantities; Adiabatic and Isothermal Process; Reversible and Irreversible Process; Second law of Thermodynamics; Standard State; Gilbb's Helmholtz equation; VantHoff Isotherm and Isochore; Maxwell Relation; Third law of Thermodynamics; Chemical Potential; Activity and Activity Coefficient; Coupled Reactions.

Module V: Chemical Equilibrium
Introduction ; Le Chatelier's Principle; Equilibrium constant from Thermodynamic Constants; Acid-Base Concept; Weak acid and Weak base and their salts; Solubility Product; pH and pOH, Buffer Solution, Buffer Action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Engineering Chmistry, Jain & Jain
- Engineering Chmistry, Shashi Chawla

References:
- Organic Mechanism, Morrison and Boyd
- Physical Chemistry, Puri Sharma and Pathania
- Organic Chemistry Vol-I, IL Finar
- Organic Chemistry Vol-II, IL Finar
- Physical Chemistry, Atkins Peter, Paula Julio
- A guide to mechanism in organic chemistry, Peter Sykes.
- Introduction to practical chemistry, K.K.Sharma
- Concise Inorganic chemistry, J.D. Lee

INTRODUCTION TO COMPUTERS

Course Code: BTB 104 **Credit Units: 03**

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction

Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types), H/W concepts (I/O Devices), S/W concepts (System S/W & Application S/W, utilities). Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C

History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Precedence of Arithmetic operators, Operator precedence of Arithmetic Operators, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C

C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types(automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions

One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations.
Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C

Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments.
Strings and C string library.
Structures and Unions. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments.
File Handling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Yashwant Kanetkar, "Let us C", BPB Publications, 2nd Edition, 2001.
- "ANSI C" by E Balagurusamy.
- Herbert Schildt, "C: The complete reference", Osbourne Mcgraw Hill, 4th Edition, 2002.
- V.Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995.

***References*:**

- Kernighan & Ritchie, "C Programming Language", The (Ansi C Version), PHI, 2nd Edition.
- J.B. Dixit, "Fundamentals of Computers and Programming in 'C'.
- P.K. Sinha and Priti Sinha, "Computer Fundamentals", BPB publication.

LIFE SCIENCES-I

Course Code: BTB 105 **Credit Units: 03**

Course Objective:

The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata and classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Invertebrates

Saileats features and outline classification of various phyla of invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II: Vertebrates

Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module-III: Lower Plants

Systematic: Recent trends in classification of Algae, Fungi, Bryophyte and Pteridophytes.

General account: Characteristic features; mode of reproduction and life cycles in Algae; Fungi including Lichens and Mycorrhiza; Bryophyte and Pteridophytes.

Economic Importance: Industrial applications; Ecological significance; Importance in agriculture.

Module-IV: Higher Plants

Systematics: Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority; Effective and valid publication; Author Citation. Broad outline of Bentham & Hooker, D.D Pant's classification

General account: General characteristic features, Distribution, mode of reproduction and generalised life cycles of Gymnosperms and Angiosperms.

Economic Importance: Industrial and ecological importance of Gymnosperms and Angiosperms

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Fundamentals of Environmental Chemistry, G.S.Sodhi, Narosa Publishers.
- Introduction to Environmental Pollution, B.K Sharma, H.Kaur, Goel Publishers.
- Biochemistry Styrier.
- Cell Biology, C B Pawar.
- Biochemistry, Lalinger.
- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain, Rastogi Publication.
- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.

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APPLIED PHYSICS LAB - I

Course Code: BTB 120 **Credit Units: 01**

List of Experiments

27. To determine the wavelength of sodium light by Newtons's rings method.
28. To determine the dispersive power of the material of prism with the help of a spectrometer.
29. To determine the specific rotation of sugar by Bi-quartz or Laurent half shade polarimeter.
30. To determine the speed of ultrasonic waves in liquid by diffraction method.
31. To determine the width of a narrow slit using diffraction phenomena.
32. To determine the temperature coefficient of platinum wire, using a platinum resistance thermometer and a Callender & Grif/fth's bridge.
33. To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
34. To determine the internal resistance of Leclanche cell with the help of Potentiometer.
35. To determine the resistance per unit length of a Carey Foster's bridge wire and also to find out the specific resistance of a given wire.
36. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.
37. To determine the value of acceleration due to gravity ("g") in the laboratory using bar pendulum.
38. To determine the moment of inertia of a flywheel about its own axis of rotation.
39. To determine the density of material of the given wire with the help of sonometer

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - I

Course Code: BTB 121 **Credit Units: 01**

List of Experiments

1. Titration of phosphoric acid and sodium hydroxide solution using pH meter.
2. Verification and application of Beer's Law.
3. Spectroscopic analysis of iron in water sample.
4. Conductometric titration.
5. Determination of water modules of crystallization in Mohr's salt.
6. (A) Determination of surface Tension of liquid.
   (B) Application of surface tension method in mixture analysis.
7. Application of distribution law in the determination of equilibrium constant.
8. Analysis of iron ore.
9. Plant pigments separation by paper chromatography.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PROGRAMMING IN C LAB

Course Code: BTB 122 **Credit Units: 01**

Software Required: Turbo C

Course Contents:

Module I

DOS commands

Module II

Creation of batch files

Module III

C program involving problems like finding the nth value of cosine series, Fibonacci series etc.

Module IV

C programs including user defined function calls

Module V

C programs involving pointers, and solving various problems with the help of those.

Module VI

File handling

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ENGINEERING GRAPHICS LAB

Course Code: BTB 123 **Credit Units: 01**

Course Objective:

This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines

Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures

Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids

Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI: Development of Surface

Development of simple objects with and without sectioning. Isometric Projection

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

- M.B. Shah & B.C. Rana, Engineering Drawing, Pearson Education, 2007
- PS Gill, Engineering Drawing, Kataria Publication
- ND Bhatt, Engineering Drawing, Charotar publications
- N Sidheshwar, Engineering Drawing, Tata McGraw Hill
- CL tanta, Mechanical Drawing, “Dhanpat Rai”

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: BTB 141 **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	**A**	**CT**	**HA**	**EE**
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

*** 30 hrs Programme to be continued for Full year**

ENVIRONMENTAL STUDIES - I

Course Code: BTB 142 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem

Structure and function of an ecosystem

Producers, consumers and decomposers

Energy flow in the ecosystem

Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

i. Forest ecosystem
j. Grassland ecosystem
k. Desert ecosystem
l. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

Biodiversity at global, national and local levels

India as a mega-diversity nation

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts

Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: BTB 143 **Credit Units: 01**

Course Objective:

This course aims at imparting:
Understanding self & process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effective on personality
Building Emotional Competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning and Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and nature of attitude
Components and Types of attitude
Importance and relevance of attitude

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, components, Importance and Relevance
Positive and Negative emotions
Healthy and Unhealthy expression of emotions

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	**SAP**	**A**	**Mid Term Test (CT)**	**VIVA**	**Journal for Success (JOS)**
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - I

Course Code:BTB 144 **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

7. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
8. dire/interroger si on comprend
9. Nommer les choses

Unité 2: Faire connaissance

5. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
6. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

15. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
16. article indéfini, défini, contracté
17. nom, adjectif, masculin, féminin, singulier et pluriel
18. négation avec « de », "moi aussi", "moi non plus"
19. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
20. pronom tonique/disjoint- pour insister après une préposition
21. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

APPLIED MATHEMATICS – II

Course Code: BTB 201 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from athematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Linear Algebra

Definition of a Matrix, Operations on Matrices Determinants, Elementary Operations, Reduction of a Matrix to Row Echelon Form, Rank of a Matrix, Consistency of Linear Simultaneous Equations, Gauss Elimination and Gauss Jordan – Method, Eigen values and Eigen Vectors of Matrix, Caley-Hamilton theorem, Diagonalization of a matrix.

Module II: Complex Number

Definition of Complex Number, Equality, Conjugate and Modulus of a Complex Number, Polar form of a Complex Number, De-Moivre's Theorem, Roots of a Complex Number, Exponential and Circular function of a Complex Number, Hyperbolic Functions and their inverses.

Module III: Vector Calculus

Scalar and vector field, Gradient, Divergence and Curl, Directional Derivative, Evaluation of a Line Integral, Green's theorem in plain (without proof), Stoke's theorem (without proof) and Gauss Divergence theorem (without proof)

Module IV: Probability and Statistics

Frequency Distribution, Arithmetic Mean, Median, Partition Values, Mode, Variance and Standard Deviation, Curve Fitting, Principle of least squares, Linear regression.

Introduction to Probability, Addition and Multiplication theorem of Probability, Random variables and Probability Distribution,Expected values, Binomial distribution, Poisson distribution and Normal.

Distribution and their Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - II

Course Code: BTB 202 **Credit Units: 03**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering.

Course Contents:

Module I: Wave Mechanics

de-Broglie matter waves, wave nature of particles, phase and group velocity, Heisenberg uncertainty principle, wave function and its physics interpretation, Operators, expectation values. Time dependent & time independent SchrÖdinger wave equation for free & bound states, square well potential (rigid wall), Concept of step potential.

Module II: Atomic Physics

Vector atom model, LS and j-j coupling, Zeeman effect & Paschen-Back effect, Bragg's law, X-ray spectra and energy level diagram, Laser – Einstein coefficient, population inversion, condition of light amplification, He-Ne and Ruby laser

Module III: Solid State Physics

Sommerfield's free electron theory of metals, Fermi energy, Energy bands in solids, physics of semi-conductors, doping, intrinsic and extrinsic semiconductors, Depletion layer, characteristics of PN junction, Forward and reverse baising, Breakdown voltage, Superconductivity, Meissner effect, Introduction to Nanomaterials

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Concept of Modern Physics, A. Beiser
- Applied Physics II, Agarawal & Goel
- Solid State Physics, S. O. Pallai
- Physics of Atom, Wehr & Richards

APPLIED CHEMISTRY - II

Course Code: BTB 203 **Credit Units: 03**

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Water
Hardness of Water; Boiler Feed Water; Scale and Sludge; Softening of Water; External and Internal Treatment of Boiler Water; Domestic Water Treatment; Domestic Water Treatment; Desalination of Brackish Water; Chemical Analysis of Water; Dissolved O_2 (BOD, COD); Estimation of Free Chlorine; TDS.

Module II: Lubricants
Introduction; Mechanism of Lubrication; Types of Lubricants; Chemical structure related to Lubrication; Properties of lubricants; Viscosity and Viscosity Index; Iodine Value; Aniline Point; Emulsion number; Flash Point; Fire Point; Drop Point; Cloud Point; Pour Point. Selection of Lubricants.

Module III: Fuel
Introduction; Characteristics of good Fuel ; Calorific value; Bomb Calorimeter; Proximate and Ultimate analysis of coal; Carbonization of coal; Gasification and Liquification of coal: Fischer Tropsch and Bergius Process; Water Gas and Producer Gas

Module IV: Polymers
Introduction; Polymerization: Addition and Condensation Polymerization; Thermosetting and Thermoplastic Polymers; Molecular Weight of Polymer; Rubber, Plastic and Fiber; Preparation, Properties and uses of PMMA, Polyester, Epoxy Resins and Bakelite, Silicone Polymers.

Module V: Corrosion
Introduction, Mechanism of Dry and Wet Corrosion, Types of Corrosion, Galvanic Corrosion, Concentration Cell Corrosion, Passivity, Underground Soil Corrosion, Pitting Corrosion, Intergranular Corrosion, Waterline Influencing Corrosion, Corrosion Control.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Engineering Chemistry-Jain & Jain
- Engineering Chemistry- Shashi Chawla

References:
- Engineering Chemistry -Dara
- Engineering Chemistry -Sunita Ratan
- Polymer Science - Gowariker, Viswanathan Sreedhar
- Corrosion Engineering – Fontenna and Greene

OBJECT ORIENTED PROGRAMMING IN C++

Course Code: BTB 204 **Credit Units: 03**

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Course Contents:

Module I: Introduction
Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module II: Classes and Objects
Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module III: Inheritance
Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hiérarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module IV: Polymorphism
Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module V: Strings, Files and Exception Handling
Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997
- R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
- "Object Oriented Programming with C++" By E. Balagurusamy.
- Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.

References:

- Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
- Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
- Yashwant Kanethkar, "Object Oriented Programming using C++", BPB, 2004

ELECTRICAL SCIENCE

Course Code: BTB 205 **Credit Units: 02**

Course Objective:

The objective of the course is to provide a brief knowledge of Electrical Engineering to students of all disciplines. This Course includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of Transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Course Contents:

Module I: Basic Electrical Quantities

Basic Electrical definitions-Energy, Power, Charge, Current, Voltage, Electric Field Strength, Magnetic Flux Density, etc., Resistance, Inductance and Capacitance. Ideal Source, Independent Source and Controlled Source

Module II: Network Analysis Techniques & Theorems

Circuit Principles: Ohm's Law, Kirchoff's Current Law, Kirchoff's Voltage Law Network Reduction: Star–Delta Transformation, Source Transformation, Nodal Analysis, Loop analysis. Superposition theorem, Thevenin's Theorem, Norton's theorem and Reciprocity theorem.

Module III: Alternating Current Circuits

Peak, Average and RMS values for alternating currents, Power calculation: reactive power, active power, Complex power, power factor, impedance, reactance, conductance, susceptance Resonance: series Resonance, parallel resonance, basic definition of Q factor & Band-width.

Module IV: Transformers

Basic Transformer Operation principle, Construction, Voltage relations, current relations, Linear circuit models, open circuit test, short circuit test, Transformer Efficiency.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- R.J. Smith, R.C. Dorf: Circuits, devices and Systems
- B.L. Thareja: Electrical Technology : Part -1 & 2
- V.Deltoro: Electrical Engineering fundamentals
- Schaum's Series: Electrical Circuits

LIFE SCIENCES - II

Course Code: BTB 206 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. Moreover paper will provide knowledge of various physiological activities of higher plants which will help them to understand the various profiles of modern biotechnology.

Course Contents:

Module I: Anatomy & Physiology of Rabbit.

- Integumentary system
- Skeletal System: Girdles only
- Digestive system
- Respiratory System

Module II: Anatomy & Physiology of Rabbit.

- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Endocrine System
- Urinogenital System

Module-III Plant Physiology-I

Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration.

Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation; Plant Hormones.

Module-IV Plant Physiology-II

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

Respiration: Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
  Shier, D., Butler, J. and Lewis, R., Hole"s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.

APPLIED PHYSICS LAB - II

Course Code: BTB 220 **Credit Units: 01**

List of Experiments

23. To determine the wavelength of prominent lines of mercury spectrum using plane transmission grating.
24. To determine the thickness of a given wire by Wedge method.
25. To determine the wavelength of He-Ne laser light using single slit.
26. To determine the frequency of an electrically maintained tunning fork by Melde's method.
27. To study the variation of magnetic field along the axis of Helmholtz coil and to find out reduction factor.
28. To draw the V – I characteristics of a forward and reverse bias PN junction diode.
29. To determine the frequency of AC mains using sonometer.
30. To determine the energy band-gap of Germanium crystal using four probes method.
31. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
32. To determine the acceleration due to gravity ("g") using Keter's reversible pendulum.
33. To study the characteristics of photo voltaic cell (Solar cell).

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

APPLIED CHEMISTRY LAB - II

Course Code: BTB 221 **Credit Units: 01**

Course Contents:

1. Determining the viscosity index of lubricating oil by using Redwood viscometer.
2. Determining the flash point and fire point of lubricating oil.
3. Determination of Hardness of Water.
4. Chemical Analysis of Water like Alkalinity, residual Chlorine.
5. Synthesis of Urea Formaldehyde resin.
6. Determination of Molecular weight of Polymer.
7. Determination of Ion exchange capacity of a region.
8. Determination of dissolved Oxygen in Water.
9. Determination of Iodine value in water.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

OBJECT ORIENTED PROGRAMMING IN C++ LAB

Course Code: BTB 222 **Credit Units: 01**

Software Required: Turbo C++

- Creation of objects in programs and solving problems through them.
- Different use of private, public member variables and functions and friend functions.
- Use of constructors and destructors.
- Operator overloading
- Use of inheritance in and accessing objects of different derived classes.
- Polymorphism and virtual functions (using pointers).
- File handling.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ELECTRICAL SCIENCE LAB

Course Code: BTB 223 **Credit Units: 01**

List of Experiments

21. To verify KVL & KCL in the given network.
22. To verify Superposition Theorem.
23. To verify Maximum Power Transfer Theorem.
24. To verify Reciprocity Theorem.
25. To determine and verify RTh, VTh , RN , IN in a given network.
26. To perform open circuit & short circuit test on a single-phase transformer.
27. To study transient response of a given RLC Circuit.
28. To perform regulation, ratio & polarity test on a single-phase transformer.
29. To measure power & power factor in a three phase circuit by two wattmeter method.
30. To measure power & power factor in a three phase load using three ammeters & three voltmeter method.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: BTB 241 **Credit Units: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses

Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation

Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

ENVIRONMENTAL STUDIES - II

Course Code: BTB 242 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

o. Air pollution
p. Water pollution
q. Soil pollution
r. Marine pollution
s. Noise pollution
t. Thermal pollution
u. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**EE**
Weightage (%)	15	5	5	5	70

INDIVIDUAL, SOCIETY AND NATION

Course Code: BTB 243 **Credit Units: 01**

Course Objective:

To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking
Thinking skills

Module II: Hindrances to Problem Solving Process
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation
Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

The six-phase model of Creative Thinking: ICEDIP model

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: **BTB 244** **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.

To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

7. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
8. rédiger un message/ une lettre pour …
    i) prendre un rendez-vous/ accepter et confirmer/ annuler
    ii) inviter/accepter/refuser
9. Faire un programme d'activités
    imaginer une conversation téléphonique/un dialogue
    Propositions- interroger, répondre

Unité 4: **Découvrir son environnement**

9. situer un lieu
10. s'orienter, s'informer sur un itinéraire.
11. Chercher, décrire un logement
12. connaître les rythmes de la vie

Unité 5 : s'informer

11. demander/donner des informations sur un emploi du temps passé.
12. donner une explication, exprimer le doute ou la certitude.
13. découvrir les relations entre les mots
14. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

CELL BIOLOGY

Course Code: BTB 301 **Credit Units: 03**

Course Objective:

Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. It incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The object of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Course Contents:

Module I
The cell theory, pre cellular evolution, prokaryotic and eukaryotic cells.

Module II
Cell cycle - molecular events, cell division, mitosis and meiosis.

Module III
Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus,lysosomes, peroxisomes, golgi bodies, and transport across membranes.

Module IV
Cell locomotion- cytoskeleton, structure and function of cilia and flagella.

Module V
Cellular signaling –general mechanism of signaling and structures of the various types of receptors.

Module VI
Types of cancer, etiology of cancer, metastasis, cytological role of p53 and p21 genes in cancer development.

Module VII
Apoptosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmilian
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.

BIOCHEMISTRY - I

Course Code: BTB 302 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Introduction aims and scope

Chemical foundations of Biology -Properties of water, acids, bases and buffers, covalent bonds, Non-covalent interactions in biological systems.

Module II

Introduction to biomolecules - *Carbohydrates* -Sugars; Polysaccharides

Lipids -classification, structure and function. Lipids and biological membranes, Lipid linked proteins and lipoproteins, Atherosclerosis.

Module III

Metabolism and bioenergetics -First and second law, free energy and chemical equilibrium, Organic reaction mechanisms, Design of metabolism-concept of free energy, ATP-ADP cycle. Cellular energy transactions -role of mitochondria and chloroplast

Module IV

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondrion and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module V

Lipid metabolism -Lipid digestion, absorption and transport, fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism. Cholesterol and Arachidonic Acid metabolism, Phospholipids, Sphingolipids and Glycolipids

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

MICROBIOLOGY

Course Code: BTB 303 **Credit Units: 04**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I

Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization,

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

MOLECULAR BIOLOGY

Course Code: BTB 304 **CreditUnits: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Course Contents:

Module I: DNA Replication and repair
Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication, DNA repair Mechanism.

Module II: Transcription
Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.

Module III: Modifications in RNA
5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

Module IV: Translation
Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.

Module V: Regulation of Gene Expression in prokaryotic and eukaryotic systems
Lac operon, Ara operan, regulation in Eukaryotes, Epigenetics.

Module VI: Antisense and Ribozyme technology
Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of Ribozyme; Hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense and ribozyme technologies.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing
- Gene VIII, Benjamin Lewin 2005, Oxford University Press

References:

- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.

DATA STRUCTURES THROUGH C++

Course Code: CSE 202 **CreditUnits: 03**

Course Objectives:

To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. To understand the notations used to analyze the Performance of algorithms. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations. To choose an appropriate data structure for a specified application. To understand and analyze various searching and sorting algorithms. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Course Contents:

Module I: Introduction to C++ (7 Hours)

C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers , friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism.

Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non Linear data structures.

Module II: Introduction to DS (6 Hours)

Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular queues-Insertion and deletion operations.

Module III: TREES (6 Hours)

Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Minimum Spanning Tree: Prim’s and Kruskal’s Algorithm, Shortest Path Algorithms.

Module IV: SEARCHING & SORTING (5 Hours)

Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods.

Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.

Module V: GRAPHS(6 Hours)

Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis, Search Trees-Binary Search Tree ADT, Definition, Operations- Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees- Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.

Course Outcomes:

- Ability to choose appropriate data structures to represent data items in real world problems.
- Ability to analyze the time and space complexities of algorithms.
- Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Able to analyze and implement various kinds of searching and sorting techniques.

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference:

- Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

CELL BIOLOGY LAB

Course Code: BTB 320 **Credit Units: 01**

Course Contents:

Module I
Microscopy: Light microscopy, Bright field, Phase contrast & Gram's staining.

Module II
Study of chromoplasts, chloroplast in plant cell.

Module III: Cell Division
Mitosis and Meiosis

Module IV
Study of permanent slides of types of cancer

Module V
Study of apoptosis

Examination Scheme:

IA			EE			
ClassTest (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

BIOCHEMISTRY LAB - I

Course Code:BTB 321 **Credit Units: 01**

Course Contents:

Module I
Colorimetric determination of pK.

Module II
Colour reactions of sugars. (Molischs test, iodine test, Saliwanoff test, Fehlings test, Benedicts test, Bials test).
Quantitative test for Carbohydrate & Protein.

Module III
Cholestrol estimation
Estimation of free fatty acids
Estimation of iodine number.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

MICROBIOLOGY LAB

Course Code: BTB 322 **Credit Units: 01**

Course Contents:

21. Preparation of solid and liquid media.
22. Isolation and maintenance of organisms by plating, streaking and serial dilution.
23. Preparation of slant cultures.
24. Growth curve measurement of bacterial population by turbidometry.
25. Measurement of bacterial population by dilution method.
26. Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.
27. Microscopic examination of bacteria by gram staining.
28. Endospore staining.
29. Capsule staining.
30. Isolation and identification of Rhizobium from root nodules.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MOLECULAR BIOLOGY LAB

Course Code: BTB 323 **Credit Units: 01**

Course Contents:

Module I
Preparation of DNA: genomic, Plasmid
Module II
Isolation of RNA
Module III
RFLP analysis
Module IV
Gel filtration
Module V
Preparation of Competent Cells
Module VI
Restriction Digestion and Ligation of DNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATA STRUCTURES THROUGH C++ LAB

Course Code: CSE 222 **CreditUnits: 01**
Total Hours : 20

Course Objectives:
To write and execute programs in C++ to solve problems using datastructures such as arrays, linked lists, stacks, queues, trees, graphs, hashtables and search trees.To write and execute write programs in C++ to implement various sortingand searching methods.
SOFTWARE REQUIREMENTS: Turbo C++ compiler or GCC compilers
List of experiments/demonstrations:

1. Write a C++ programs to implement recursive and nonrecursivei) Linear search ii) Binary search
2. Write a C++ programs to implement i) Bubble sort ii) Selectionsort iii) quick sort iv) insertion sort
3. Write a C++ programs to implement the following using an array.

a) Stack ADT b) Queue ADT

4. Write a C++ programs to implement list ADT to perform followingoperations
   a) Insert an element into a list.
   b) Delete an element from list
   c) Search for a key element in list
   d) count number of nodes in list

15. Write C++ programs to implement the following using a singly linked list. Stack ADT b) Queue ADT
6 Write C++ programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.
9. Write a C++ program to perform the following operations:
a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.
8 Write C++ programs for implementing the following sorting methods:
Merge sort b) Heap sort
9.Write C++ programs that use recursive functions to traverse the given binary tree in a) Preorder b) in order and c) post order
10 Write a C++ program to perform the following operations
c) Insertion into a B-tree b) Deletion from a B-tree

Course Outcomes:

- Ability to identify the appropriate data structure for given problem.
- Graduate able to design and analyze the time and space complexity ofalgorithm or program.
- Ability to effectively use compilers includes library functions, debuggersand trouble shooting.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and.Mount, Wiley student edition, John Wiley and Sons.
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 Course Credit: 01

Course Objective:

To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin, indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

11. lesadjectifsdémonstratifs
12. lesverbes:'irgroupe'devoir,falloir
13. lesprépositionsdelieu,depays
14. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
15. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA

TERM PAPER

Course Code: BTB 330 Credit Units: 02

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

13. Choosing a subject
14. Finding sources of materials
15. Collecting the notes
16. Outlining the paper
17. Writing the first draft
18. Editing & preparing the final paper

13. Choosing a Subject

The subject chosen should not be too general.

14. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

15. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

16. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

17. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

18. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
    (i) Show evidence of what an author has said.
    (ii) Avoid misrepresentation through restatement.
    (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

21) Title page
22) Acknowledgement
23) Abstract
24) Table of contents
25) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
26) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
27) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
28) Results (If any)
29) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
30) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

e) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[5] Pandian, P.S.,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.

[6] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOCHEMISTRY - II

Course Code: BTB 401 **Credit Units: 04**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Proteins -Amino acids and peptides - classification, chemical reactions and physical properties. Introduction to protein structure and function. Cis-trans peptide bond formation. Glycoproteins -structure and function, *Vitamins and Coenzymes*: structure and function of water soluble vitamins.

Enzymes -Introduction to kinetic and catalytic mechanisms of enzymes; Regulation of enzyme activity; Effects of physical parameters on enzyme activity, enzyme inhibitors – types of inhibition.

Module II

Nucleic acids - nitrogenous bases, nucleotides, types, structure and properties of nucleic acids

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, biosynthesis and breakdown of nutritionally non-essential amino acids (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine. Specialized Products of Amino Acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines, biosynthesis of nucleotide coenzymes (NAD, NADP, FAD, FMN; Catabolism of heam and clinical significance of bilirubin.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

GENETICS

Course Code: BTB 402 **Credit Units: 04**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.

Course Contents:

Module I

The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.

Module II: Mendelism

Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture.

Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.p

Module III

Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.

Module IV

Mutation and mutagenic agents, types of mutations, economic importance of mutation

Module V

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage

Module VI: Genetics of Population

Hardy- Weinburg Law and its deviations.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genetics, P.K. Gupta, Rastogi Publication
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

- Genetics, M.W. Strickberger, Prentice Hall College Division
- Genetics, P.J.Russell, Benjamin/Cummings
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.
- Genetics, R. Goodenough, International Thomson Publishing
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: BTB 403 **Credit Units: 03**

Course Objective:

The students will be exposed to techniques and instruments that are used in biotech industries.

Course Contents:

Module I: Electrophoresis

Agrose Gel electrophoresis, PAGE, SDS-PAGE, isoelectric focusing, two-dimensional electrophoresis, immuno electrophoresis, capillary electrophoresis

Module II: Chromatography

Paper, TLC, gel filtration, ion-exchange chromatography, affinity chromatography, HPLC and GLC

Module III: Spectroscopy

UV and visible spectroscopy ,Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Mass Spectrometry, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy,

Module IV

XII- ray diffraction and X-ray Crystallography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wi

CHEMICAL BIOLOGY

Course Code: BTB 404 **Credit Units: 03**

Course Objective:

Chemical biology is that branch of life science, which deals with the study and manipulation of biological systems through the application of chemical techniques and tools. It differs from the more traditional disciplines of chemistry and biology in its emphasis on integrating a wider series of experimental techniques, ranging from synthetic organic chemistry, to biochemistry, to structural, molecular, and cellular biology. Chemical biology has historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry and metabolic engineering.

Course Contents:

Module I: Principles of chemical biology
Chemistry of carbohydrates, proteins and nucleic acids, strategies for identifying the cellular target of physiologically active natural products (paclitaxel, vancomycin), chemical aspects of signal transduction
Module II: Chemical reactions in living systems
Introduction to enzyme chemistry, Group transfer reactions, Substitutions, Carboxylation and decarboxylation, Isomerases, Eliminations and additions, Redox reactions (1), Redox reactions (2), Aldol and Claisen Reactions, One-carbon transfer reactions, Rearrangements
Module III: Structural chemical biology
Purine biosynthesis, polyamide biosynthesis, thiamine biosynthesis, vitamin E biosynthesis, proteases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Chemical Biology by H. Gobind Khorana
- Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH
- Foundations of Chemical Biology, C.M. Dobson, J.A. Gerrard, A.J. Pratt, Oxford Chemistry Primers
- Innovations in Chemical Biology, Sener Bilge, Springer
- Chemical biology by Stuart L. Shreiber, Tarun Kapoor, Gunther Wess, Wiley-VCH.

References:

- A General Method for Discovering Inhibitors of Protein−DNA Interactions Using Photonic Crystal Biosensors *Chem. Biol.*, 2008, *3* (7), pp 437–448.
- Optimization of non-natural nucleotides for selective incorporation opposite damaged DNA Org. Biomol. Chem., 2007, 5, 3623 – 3630.

DATABASE MANAGEMENT SYSTEMS

Course Code: CSE 304 **Credit Units: 03**

Course Objective:

The objective of this course is to get students familiar with Databases and their use. They can identify different types of available database model, concurrency techniques and new applications of the DBMS.

Course Contents:

Module I: Introduction (6 Hours)

Concept and goals of DBMS, Database Languages, Database Users, Database Abstraction.

Basic Concepts of ER Model, Relationship sets, Keys, Mapping, Design of ER Model, Concept of Generalization, Aggregation and Specialization. Transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model.

Module II: Relational Data models (6 Hours)

Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages:SQL-DDL, DML, integrity constraints, Complex queries, various joins, indexing, triggers,Relational algebra and relational calculus, Relational algebra operations like select, Project,Join, Division, outer union. Tuple relational calculus.

Module III: Data Base Design (6 Hours)

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies.

Module IV: Transaction Processing Concepts (6 Hours)

Transaction System, Testing of Serilizability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling.Concurrency Control Techniques: – Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction.

Module V: Relational Database Management Systems (6 Hours)

Study of Relational Database Management Systems through Oracle/Postgres SQL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi-threaded server, distributeddatabase. Introduction of ANSI SQL. Usage of like, any, all, exists, views and other commands, Special operators. Hierarchical queries, inline queries, flashback queries

Course Outcomes:

The student will learn

- Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
- Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
- Learn and apply structured query language (SQL) for database definition and database manipulation.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Korth, Silberschatz, “Database System Concepts”, 4th Ed., TMH, 2000.
- Steve Bobrowski, “Oracle & Architecture”, TMH, 2000

References:

- Date C. J., “An Introduction to Database Systems”, 7th Ed., Narosa Publishing, 2004
- Elmsari and Navathe, “Fundamentals of Database Systems”, 4th Ed., A. Wesley, 2004
- Ullman J. D., “Principles of Database Systems”, 2nd Ed., Galgotia Publications, 1999.

BIOCHEMISTRY LAB - II

Course Code: BTB 420 **Credit Units: 01**

Course Contents:

Module I

Colour reactions of proteins (Ninhydrin test, Biuret test, Xanthoprotein test).

Estimation of proteins.

Module II

Biochemical estimation of DNA

Biochemical estimation of RNA

Quantitative determination of DNA and RNA by spectrophotometric method using UV range.

Determination of melting temperature of DNA from thermal denaturation characteristics.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS LAB

Course Code: BTB 421 **Credit Units: 01**

Course Contents:

1. Study of gene interaction.
2. Study of chromosomal translocation in Rhoeo discolor.
3. Study of bacterial conjugation.
4. Study of bacterial transduction.
5. Study of physical and chemical mutagens on growth of E. coli.
6. PTC test.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: BTB 422 **Credit Units: 01**

Course Contents:

Module I
Cell disruption techniques

Module II
Centrifugation – low speed and high speed.

Module III
Spectrophotometer techniques

Module IV
Chromatography –Paper Chromatography and Thin Layer Chromatography

Module V
Electrophoresis –SDS Page and Agarose gel electrophoresis.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DATABASE MANAGEMENT SYSTEMS LAB

Course Code: CSE 324 **Credit Units: 01**

Software Required: Oracle 9i **Total Hours: 20**

Topics covered in lab will include the following Programs:

1. Using create command design three specific table and the table structure is given below.

Table name- Book

ISBN	TITLE	PUB_YEAR	UNIT_PRICE	AUTHOR_NAME	PUB_NAME
1001	Oracle	2004	399	Arora	phi
1002	Dbms	2004	400	Basu	technical
2001	Dos	2003	250	Sinha	nirali
2002	Adbms	2004	450	Basu	technical
2003	Unix	2000	300	Kapoor	scitech

Table name- Author

AUTHOR_NAME	COUNTRY
Arora	U.S.A
Kapoor	Canada
Basu	India
Sinha	India

Table name- Publisher

PUB_NAME	PUB_ADD1
Phi	Delhi
Technical	Pune mainmarket
Nirali	Mumbai
Scitech	Chennai

2. Write the SQL query to find the name of all publisher from Book relation.
3. Write the SQL query to display the name of all publisher using distinct clause.
4. Write the SQL query to find the names of author from the author table where the first two characters of names are 'ba'.
5. Write the SQL query to display title of books published in year 2004.
6. Write the SQL query to display title of books having price between 300 to 400.
7. Write the SQL query to display title of books having price between 300 to 400 using operators.
8. Write the SQL query to display title of books with author_name and country published in year 2004.
9. Write the SQL query to display all title and (unit_price*10) as an attribute from book table using arithmetic expression.
10. Write the SQL query to add the new column in all three tables.
11. Study the concept of Views and their utility in DBMS ,write the SQL query to design a view.
12. Write the SQL query to make the attribute ISBN as a primary key in Book relation.
13. Write the SQL query to display the all the titles of Books with price and year in descending order.
14. Write the SQL query to study the use of Delete and Drop command in DBMS.
15. Study the concept of Triggers, cursors and Stored procedures in DBMS.

Course Outcome:

- At the end of lab session students would be able to design the Database application for the real life projects.
- Students would be able to perform insertion, deletion and updation operation on Databases.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford:***

St. Martin's Press, 2010. Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building- New-self awarness

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.
Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl'imparfait,comparer(nometverbe),qualifier(qui,que)s' exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

7. l'imparfait,
8. lacomparaisonduverbe/dunom ; mieux/meilleur
9. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:

Text:

Le livre àsuivre:

Andant,Christineetal.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,Brunoet NellyMous.ReussirleDELFA1.Paris: Didi

PLANT BIOTECHNOLOGY

Course Code: BTB 501 **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I

Historical perspective of plant tissue culture.
Tissue culture lab and organization
Sterilisation techniques
Types of nutrient media and media composition
Plant regeneration pathways
Role of phytohormones
Cell culture techniques- cell, tissue, organ cultures, callus culture, suspension culture
Culture techniques Callus culture, cell culture and protoplast cultures.

Module II

Organogenesis and somatic embryogenesis.
Applications of plant tissue and cell culture.
Micropopogation, pathogen free plants. production haploids,
Somaclonal variation.preservation of germplasm.

Module III

Genetic engineering in plants, - transformation vectors
Gene transfer techniques-vector meditated and vector less gene transfer.
Transgenic plants Tran's gene integration and expression

Module IV

Transgenic crop with new traits-herbicide tolerance, insect and disease resistance,
Therapeutic proteins and compounds
Oral vaccines
Production of secondary metabolites via tissue culture
Bioethics of plant genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: BTB 502 **Credit Units: 03**

Course Objective:

The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I

Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering.

Module II

Cell culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures

Module III

In vitro fertilization and embryo transfer

Module IV

Somatic cell hybridization, hybridoma technology

Module V

Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer

Module VI

Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc.

Module VII

Bioethical issues related to animal biotechnology,

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

STRUCTURAL BIOLOGY

Course Code: BTB 503 **Credit Units: 03**

Course Objective:
The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

Course Contents:
Module I: Chemistry of amino acids and peptides
Side chain structure and function in protein folding and functionality: Secondary structure of proteins -helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Structure and function of an antibody; structure of hemoglobin, muscle proteins; Sequence and structural motifs in proteins.

Module II: Protein-ligand interactions
Lock and key versus handshake mechanism of substrate recognition; structural basis of recognition; reaction mechanisms of enzymes, G-Protein coupled receptors.

Module III: Protein solubility, protein stability and stabilization
Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding

Module IV: DNA structure
Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules -Rasmol, Deepview, Whatif.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Biochemistry, R.H. Abeles, P.A. Frey and W.A. Jencks, Jones and Bartlett.
- Essentials of Molecular Biology, D. Freifelder, Jones and Bartlett Publications.
- Genes VII, B. Lewin, Oxford University Press.

References:
- Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company.
- Protein Structure, M. Perutz, Oxford University Press.
- Proteins (Structures and Molecular Properties), T.E. Creighton, W.H. Freeman and Company.
- Database Annotation in Molecular Biology, Arthur M. Lesk.
- From Genes to Clones, E.L. Winnacker.
- Genes & Genomes, M.S. Paul Berg.
- Structure and Machanism in Protein Science, Alan Fersht.

CHEMICAL ENGINEERING PRINCIPLES

Course Code: BTB 504 **Credit Units: 03**

Course Objective:

The knowledge gained through chemical reaction engineering and material and energy balances will help the students to understand the tools and techniques of biotechnology.

Course Contents:

Module I: Material and Energy Balances

Units and dimensions, Dimensional analysis; Simple problems on material balance calculations involving unit processes and reactive systems; Available electron balances.

Basic energy concepts -enthalpy changes in chemical/biochemical reactions and in non-reactive processes, Energy balance calculations, Use of Steam tables; Heat of reaction and energy balance for microbial processes.

Module II: Chemical reaction engineering

Kinetics of homogenous reactions: Concepts of reaction rate, order of reaction and molecularity, Analysis of batch reactors for kinetic interpretation of data and isothermal reactor design for single and multiple reactions, Design equations for CSTR and plug flow reactors.

Module III: Instrumentation and process control

Principles of measurement: error, accuracy and sensitivity; Measurement of flow, pressure, temperature, level, pH, viscosity and chemical composition.

Basic concepts of feedback control, control loop and its elements, Dynamic behaviour of first, second and higher order physical systems, controller hardware, choice of controllers and settings. Introduction to advanced control systems: feed forward, cascade and ratio control.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, Prentice Hall
- Basic Principles of Chemical Engineering, E.I. Shaheen, Houghton Mifflin

References:

- Chemical Process Control, An introduction to Theory and Practice, G. Stephanopoulos, Prentice Hall Inc.
- Chemical Reaction Engineering, O. Levenspiel, John Wiley and Sons Inc.
- Elementary Principles of Chemical Processes, R.M. Felder and R.W. Rousseau, John Wiley and Sons Inc.
- Fundamentals of Chemical Reaction Engineering, C.D. Holland and R.G. Anthony, Prentice Hall Inc.
- Process Modelling, Simulation and Control for Chemical Engineers, W.L. Luyben, McGraw Hill

BASIC BIOANALYTICAL TECHNIQUES

Course Code: BTB 505 **CreditUnits: 03**

Course Objective:
The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

Course Contents:
Module I: Solution and Buffers
Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.

Module II: Centrifugation
Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation.

Module III:Microscopy
Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy.
Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

Module IV: Radioisotope techniques
Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio – immunoassay.

Module V
Cell Disruption techniques, ultra filtration, dialysis and reverse osmosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:
- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

JAVA PROGRAMMING

Course Code: CSE 403 **CreditUnits: 3**
Total Hrs: 30

Course Objective:

The objective is to impart programming skills used in this object oriented language java.The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I(7 Hours)

Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison.Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays

Module II(7 Hours)

Classes and Objects in Java: Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces.Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages.

Module III(6 Hours)

Multithreaded Programming:Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication.Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.

Module IV(7 Hours)

GUI Programming -Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers, Swing Packages, Exploring Swing components ,Generating Swing Application

Module V(3 Hours)

Event Handling -The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**ESE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH
- Introduction to JAVA Programming a primar, Balaguruswamy.

References:

- “Introduction to JAVA Programming” Daniel/Young PHI
- Jeff Frentzen and Sobotka, “Java Script” , Tata McGraw Hill,1999

Course Outcomes:

The student will learn

- Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- Students can demonstrate ability to implement multithreading in the programming.
- To learn syntax and features of exception handling
- Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings.
- To demonstrate the ability to handle Events in the Programming

PLANT BIOTECHNOLOGY LAB

Course Code: BTB 520 **Credit Units: 01**

Course Contents:

Module I
Sterilization of glasswares and equipments.
Preparation of cotton plugs and culture media
Preparation of stocks for culture media
Preparation of culture media

Module II
Preparation and sterilization of different explants
Inoculation of explants on culture media

Module III
Study of viability of seeds
Embryo culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL BIOTECHNOLOGY LAB

Course Code: BTB 521 **CreditUnits: 01**

Course Contents:

9. Preparation, standardization and sterilization of culture media
10. Inoculation of specific tissues for callusing
11. Inoculation and maintenance of cell lines
12. Study of toxicity on cell lines

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

STRUCTURAL BIOLOGY LAB

Course Code: BTB 522 **Credit Units: 01**

Course Contents:

13. Study of physical properties of proteins.
14. Analysis of protein structure.
15. Study of protein finger printing
16. Study of protein fractionation
17. Study of protein folding
18. Study of protein degadation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

JAVA PROGRAMMING LAB

Course Code: CSE 423 Credit Units: 2

Course Objective:

Programming in the Java programming language, knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

5. **Lab assignment will be based on the following: (40 Hours)**
    1. Use Eclipse or NetBeans platform and acquaint with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop. :**(2 Hours)**
    2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero. :**(2 Hours)**
    3. Develop an applet in Java that displays a simple message. :**(1 Hours)**
    4. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked. :**(1 Hours)**
    5. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 andNum2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box. :**(2 Hours)**
    6. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. :**(2 Hours)**
    7. Write a Java program that connects to a database using JDBC and does add, delete, modify and retrieve operations. :**(1 Hours)**
    8. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially there is no message shown. :**(1 Hours)**
    9. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape. : **(1 Hours)**
    10. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout. :**(2 Hours)**
    11. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes). :**(1 Hours)**
    12. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab. It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables). :**(1 Hours)**
    13. Implement the above program with database instead of a text file. :**(1 Hours)**
    14. Write a Java program that takes tab separated data (one record per line) from a text file and inserts them into a database. :**(1 Hours)**
    15. Write a java program that prints the meta-data of a given table. :**(1 Hours)**

2 **Students are required to develop anJAVA based application or model as project.**

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

- Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

Text:

- Java Fundamentals - A comprehensive Introduction, HerbetSchidt and Dale Srien, TMH.

References:

- Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI.
- Object Orientd Programming through Java, P. Radha Krishna, Universities Press.
- Thinking in Java, Bruce Eckel, Pearson Education
- Programming in Java, Bruce Eckel, Pearson Education
- Programming in Java, S. Malhotra and S. Choudhary, Oxford Univ. Press.

Course Outcome:

- knowledge of the structure and model of the Java programming language, (knowledge)
- use the Java programming language for various programming technologies (understanding)
- develop software in the Java programming language, (application)
- evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
- propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

COMMUNICATION SKILL-V

Course Code: BCU 541 — Credit Units: 1

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Vocabulary**	**35% Weightage**
	• Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	
2.	**Module II Comprehension Skills**	**25% Weightage**
	• Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools.	
6.	**Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensemble

ActesdeCommunication:

Exprimerlacause,l’opposition,laconséquence,décrirelesétapesd’uneaction,s’exprimersurl’environnement,
l’écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd’une association,fairela biographied’une personne.

Dossiers4, 5,6–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

9. le présent (révision),lepassé composé(révision)
10. lespronomscomplémentsdirects,lespronomscompléments indirects
11. lesmarqueurschronologiques
12. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

SUMMER PROJECT - I

Course Code: BTB 560 **Credit Units: 05**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate’s name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.7 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.7.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.7 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

RECOMBINANT DNA TECHNOLOGY

Course Code: BTB 601 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I: Enzymes used in RDT

Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.

Module II: Cloning vectors

Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering

Module III: Blotting techniques and hybridization

Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.

Module IV: Nucleic acid amplification and its applications

Principles of PCR, designing of primers

Module V: Cloning Techniques

Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure , Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immunoscreening.

Module VI: DNA Libraries

Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries.

Module VII: Sequencing of DNA

DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor
- Laboratory Press.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: BTB 602 **Credit Units: 03**

Course Objective:
The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Michaelis Menten equation, Linear plots, King-Altman's method; Inhibitors and activators; Multisubstrate systems; ping-pong mechanism, Alberty equation, Sigmoidal kinetics and Allosteric enzymes

Module III
Immobilization of Enzymes; Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects.

Module IV: Enzyme reactors
Reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems, Mass transfer in enzyme reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reaction.

Module V: Bioprocess Design
Physical parameters, reactor operational stability, Immobilized cells.

Module VI: Challenges and future trends
Enzyme catalysis in organic media; catalytic antibodies and non protein biomolecules as catalysts, biocatalysts from extreme thermophilic and hyper thermophilic Archae and Bacteria.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:
Text:
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.

References:
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner.
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience.
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: BTB 603 **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I: Introduction
Phylogeny of Immune System, Innate and acquired immunity, clonal nature of Immune Response.
Organization and structure of lymphoid organs Nature and Biology of antigens and super antigens Antibody structure and function; Types of immunity- innate, acquired, active and passive.
Module II: Major Histocompatibilty
MHC, BCR and TCR, generation of antibody diversity, Complement system
Module III: Cells of the immune system
Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T -Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells
Module IV: Regulation of immune response
Antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance
Module V: Cell mediated toxicity
Mechanism of T cell and NK cell mediated lysis and macrophage mediated cytotoxicity.
Module VI: Hypersensitivity
Module VII: Autoimmunity
Module VIII: Tumor immunology, Immunity to infectious agents
Module IX: Transplantation Immunology

Module X: Synthetic vaccines
Vaccines: General consideration, ideotype network hypothesis, Synthetic vaccines

Module XI: Hnmunological Techniques
Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter

Module XII: Hybridoma technology and its applications
Fusion of myeloma cells with lymphocytes

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

COMPUTATIONAL BIOLOGY

Course Code: BTB 604 **Credit Units: 03**

Course Objective:

The objective is to describe relational data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures genetic mapping etc.

Course Contents:

Module I: Introduction and overview

The NCBI data model; sequence databases, sequence retrieval, sequence file formats, submitting DNA and protein sequences.

Types of biological databases, Databases and rapid sequence analysis

Module II: Sequence alignment

Global and local alignments, statistical significance of alignments, scoring matrices and gap penalties, filtering, position specific scoring matrices, internet resources, Pairwise and multiple alignment, uses of pairwise and multiple sequence alignment, programs and methods for sequence alignment, pattern searching programs, family and superfamily representation, structural inference, dynamic programming algorithms, alignment by hidden Markov models, consensus word analysis, more complex scoring.

Module III: Phylogenetic prediction

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module IV: Predictive methods using DNA and protein sequences

ESTs – databases, clustering, gene discovery and identification, and functional classification.

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification;

Module V

Molecular modeling – PDB and MMDB, structure file formats, visualizing structural information, advance structure modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Molecular mechanics and dynamics, Docking of Molecules, Knowledge base structure prediction, Molecular Design, structure similarity searching; Secondary structure prediction in proteins, prediction of buried residues in proteins;

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F Quellette, Wiley – interscience.
- Bioinforamtics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. Von Heijne and G. Von Heijne, Academic Press.

FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Course Code: BTB 605 **Credit Units: 03**

Course Objective:

The course material on the kinetics of microbial growth, substrate utilization and product formation etc. may help the students to understand the various principles involved in instrumentation and control of bioprocess.

Learning outcome:

After successful completion of the course student will be able to:

- Learn the different phases of microbial growth, kinetics of substrate utilization and product formation.
- Understand various sterilization techniques and its principles.
- Familiarize themselves with the different parts, function and types of bioreactors and valves.
- Understand the mass transfer phenomenon, principles involved in instrumentation and control of bioprocess.

Course Contents:

Module I

Kinetics of microbial growth, substrate utilization and product formation.

Module II

Sterilization of air and medium.

Module III

Batch, continuous ,cell recycle and fed batch reactors; mass and energy balance in microbial processes, Bioreactor design, Different types of bioreactors, their parts and functions. Different types of valves.

Module IV

Mass transfer in Biological reactions; Scale-up principles; Instrumentation and control of bioprocesses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Biochemical Engineering Fundamentals, J E Baily and D F Oillis, McGraw Hill
- Bioprocess Engineering Principles, P Doran, Academic Press

References:

- Chemical Engineering, J M Coulson, and J F Richardson, Butterwirth Heinemann
- Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, HC Vogel, CL Todaro, CC Todaro, Noyes Data Corporation/Noyes Publications
- Process Engineering in Biotechnology, A T Jackson, Prentice Hall

RECOMBINANT DNA TECHNOLOGY LAB

Course Code: BTB 620 **Credit Units: 01**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

Module I

Study of cloning (GFP CLONING)

Module II

Study of PCR

Module III

Study of Southern hybridiosation

Module IV

Study of RAPD

Module V

Site directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code:BTB 621 **CreditUnits: 01**

Course Objective:

The laboratory will help the students to isolate enzymes from different sources, enzyme assays and studying their kinetic parameters which have immense importance in industrial processes.

Course Contents:

Module I

Isolation of enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulase, protease.

Module III

Purification of Enzyme by ammonium sulphate fractionation.

Module IV

Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity, determination of Michaelis-Menten constant (K_m) and Maximum Velocity ($V_{max.}$) using Lineweaver-Burk plot.

Module V

Effect of Temperature and pH on enzyme activity.

Module VI

Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: BTB 622 **CreditUnits: 01**

Course Contents:

Module I
Blood film preparation and identification of cells.
Module II
Identification of blood group.
Module III
Isolation of serum.
Module IV
Lymphoid organs and their microscopic organization.
Module V
WIDAL Test
Module VI
Radial Immuno Diffusion Test
Module VII
Ouchterlony Double diffusion Test
Module VIII: Elisa
DOT, SANDWICH
Module IX
Purification of lgG through affinity chromatography
Module X
Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMPUTATIONAL BIOLOGY LAB

Course Code: BTB 623 **CreditUnits: 01**

Course Contents:

List of Experiments/Exercises.

19. Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
20. Local and Global Alignment- concepts Pair wise sequence alignment
21. Multiple sequence alignment
22. Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
23. Motif and pattern searching
24. Phylogentic prediction and analysis
25. Structure predicition
26. Finding transcription regulatory signals
27. Docking

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 Credit Units: 1

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:

vii) express their sentiments, emotions and opinions, reacting to information, situations;

viii) narrate incidents, events;

ix) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

13. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser

6. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

BIOPROCESS TECHNOLOGY

Course Code: BTB 701 **Credit Units: 03**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process

Module II

Process technology for the production of primary metabolites, eg. Biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides

Module III

Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture

Penicillin: Classification, various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc.

Streptomycin: chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc.

Tetracycline: chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.

Module IV

Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Bioprocess Engineering Principles, P Doran, Academic Press
- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press
- Process Engineering in Biotechnolgy, A T Jackson , Prentice Hall

DOWNSTREAM PROCESSING

Course Code: BTB 702 **Credit Units: 03**

Course Objective:

The syllabus will help the students to characterize the Bioproducts due to downstreaming process of biotechnological importance.

Course Contents:

Module I
Characteristics of Bioproducts; Coagulation, Flocculation and conditioning of broth.

Module II
Mechanical separation; Cell disruption techniques

Module III
Protein precipitation and separation

Module IV
Aqueous- two- phase extraction, Adsorption-desorption processes

Module V
Chromatographic methods of separation based on size, charge, hydrophobic interactions and biological affinity

Module VI
Membrane based separation; Dialysis, Electrodialysis; Micro filtration, Ultra filtration; Electrophoresis

Module VII
Crystallization; Drying

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill.
- Bioseparatioins, P.A. Belter, E.L. Cussler and W.S. Hu, John Wiley and Sons Inc.Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering / Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society.
- Protein Purification, M.R. Ladisch, R.C. Willson, C.C. Painton and S.E. Builder, American Chemical Society.

STATISTICS FOR BIOLOGY

Course Code: BTB 703 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice.

Course Contents:

Module I

Statistics and Biostatistics: Preliminary concepts.
Measures of Central Tendency: Mean, Median, Mode
Measures of Dispersion: Range, Standard deviation, Variance

Module II

Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.

Module III: Continuous Distribution

Normal Distribution, Properties of Normal distribution

Module IV: Correlation

Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, some examples.

Module V: Regression

Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples. Method of least square: Fitting of straight line

Module VI: Introduction to the following Statistical terms

Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications.
Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test.
Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means.
Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity.
Analysis of Variance: One way and two way (only Examples)

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
- Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
- Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand & Co.

References:

- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons
- Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
- Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

BIOSENSORS

Course Code: BTB 704 **Credit Units: 03**

Course Objective:

The course aims at developing an understanding of Biosensor technology needed critically for the development of small, sensitive, and selective biosensor devices and detection systems that can reliably operate in real time and in extreme and diverse physical environments. Biosensors are important tools in food safety diagnostics, medical monitors, and detection systems for biological warfare agents.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and trnsducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Affinity Biosensors: Techniques and Protocols, K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applicatrions, V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors, B.R. Eggins, John Wiley and Sons Inc.
- Sensors and Sensing in Biology and Engineering, F.G. Barth, wt al, Springer Verlag.

THERMODYNAMICS OF BIOLOGICAL SYSTEMS

Course Code: BTB 705 **Credit Units: 03**

Course Objective:

The main aim is to understand the basis of theories related to combustion and dissolution. It will help in the study of heat evolution, control of dissipation and will suggest ways for solving the rate phenomena through the dynamics of mass transfer applicable to biological process

Course Contents:

Module I
Energy, thermodynamics and living processes - an introduction

Module II
Energetic processes in the biosphere: The ecosystem.

Module III
Thermodynamics systems: equilibrium, activity coefficients and phase equilibrium functions of state, cyclic processes, work, energy and metabolic heat; Mechanical equivalent of heat, energy as a function of state.

Module IV: The laws of thermodynamics
Second law; Reversible vs. irreversible processes entropy, work; Combination of the first and second law, Free energy, useful work and delta G. Entropy: Ideality and Molecular Cohesion, Probabilistic nature of Entropy, Order and Disorder.

Module V: Biological systems as open, non-equilibrium systems
Failure of classical thermodynamics in describing biological processes, Standard free energy changes and equilibrium constants, direction and rate.

Module VI: Chemical potential
Visualization of the potential velocity and steady flow; Fick's law and diffusion. Local Equilibria and steady state: Energy vs. Power; Transducers in biological states, Constitutive equations, Dynamic efficiency and Onsager (nonequilibrium thermodynamics), Prigogine's principle, Spontaneous coupling and entropy production.

Module VII: Non-equilibrium thermodynamics
Reversible work, exact differentials and function of state, first and second law, The electrochemical potential, External forces an steady state, Fick's Law, chemical reactions in the steady state, internal entropy production, cells as non-equilibrium stationary states; Diffusion and membrane transport. Thermodynamic analysis of oxidative photophospghorylation, stability of non-equilibrium stationary states, ordering in time and space far from equilibrium, glycolytic oscillations, biological clocks, routes to chaos.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Bioenergetics, A.L. Lehninger, W.A. Benjamin Inc.
- Biological Thermodynamics, D.T. Haynie, Cambridge University Press.
- Biophysical Chemistry, C.R. Cantor and P.R. Schimmel, Freeman
- Physical Chemistry: Principles and Applications in Biological Sciences, I. Tincoco, K.Sauer and J.C. Wang, Prentice Hall College Division.
- Physical Chemistry for the Chemical and Biological Sciences, R. Chang, University Science Books
- Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, John Wiley and Sons Inc.

PHARMACEUTICAL CHEMISTRY AND DRUG DESIGN

Course Code: BTB 706 **Credit Units: 03**

Course Objective:

The main objective of this course is to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. The contents will introduce them to various drug molecules used in treatment, mitigation and cure of different disease. The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I

Introduction of pharmaceutical Chemistry, Overview of drug discovery process.

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action

Module II: Drug Targets and their validation

Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins

Validation Strategies

Module III: Drug Design Strategies

A. Structure-based design-Docking and denovo methods

B.Design and development of combinatorial libraries for new lead generation

The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemiometrics in drug design.

C. QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.

Module IV

Drug toxicity, tolerance, dependence, addiction, Dose Response curves

Module V

Survey of various Drug Classes – Anaesthetics (general, local), Analgescis, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids- Mechanism of action and applications

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press
- Pharmaceutical Dosage forms and Drug Delivery Systems, H.C. Ansel , L.V. Allen, N.G. Popovich, Lippincott Williams and Wilkins Publishers
- Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry, T.L. Lemke, Lea and Febiger

CURRENT TOPICS IN BIOTECHNOLOGY

Course Code: BTB 707 **Credit Units: 03**

Course Objective:

A complete understanding of the application of biotechnology in various fields can be understood by studying the various modules of this paper. Success of biotechnology depends largely on how it can be effectively utilized in finding solutions to many vexed problems of present day society. The objective of this paper is to familiarize the students with some of the frontier areas if biotechnological applications where a huge scope for further contributions for betterment of the society exists. The paper shall be a interface between the students and the social at large.

Course Contents:

Module I: Bioremediation

Introductory concept, Bioremediation principles, mechanism for Bioremediation of air, water and soil pollutants, bioremediation examples, commercial application of bioremediation techniques, recombinant DNA technology and bioremediation, bioremediation models, bioremediation software

Module II: Genetically modified organisms

Genetically modified food crops, food animals – examples and mode of production, future goals in GM food crops and animals, scientific evaluation of public concerns, legal requirements in production of GMO, current trends and consumer acceptance.

Module III: Molecular medicine

Gene mutation, point mutation, allele specific oligonucleotides, ARMS, oligonucleotide ligation, disease diagnosis with linked genetic markers, fluorescently labeled DNA sequencing.

Module IV: Nano-biotechnology

Introduction, definition, hybrid nanopracticles, smrat drug delivery, gene sensors, biomolecule control, nanofluids, nanotechnology in medicine.

Module V: Stem cells

Definition, properties, proliferation, culture of stem cells, medical applications of stem cells, ethical and legal issues in use of stem cells.

Module VI: Cancer Biology

Types of cancer, development, causes and properties of cancer, viruses (Hepatitis B & C, SV4U, polymo marines, pupillomarines, adenosines, retrovineses); retroviral oncogenes, proto-oncogenes, turmor suppressor genes, recent advances in detection and treatment of cancer.

Module VII: Forensic Biotechnology

MLP, SLP technology, PCR technology in crime detection, STR and databases, mitochondrial DNA and Y chromosome analysis in forensic science, DNA chip technology, role of molecular biology and biotechnology in crime detection.

Module VIII: Bio sensor

Biological reaction, amperometric biosensor, potentiometric biosensor, conductimetric bioseosors, calorimetric biosensor, piezoelectric biosensor, whole-cell biosensor, immunosensors.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- The Cell – A molecular Approach, 3rd Edn, Geoffrey M. Cooper and Robert E. Hausman, ASM Press
- Molecular Biology and Biotechnology, 4th Edn, J.M Walker and R. Rapley, Panima Books
- Cell Biology, David. E. Sadava, Panima Books
- Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press
- Environmental Microbiology, 2nd Edition, Ian L.Pepper and Charles P. Gerba, Elsevier Pub.
- Environmental Biotechnology – Concepts and Application, Hans – Joachim Jordening and Jesefwinter – Wiley – VCH

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BTB 708 **Credit Units: 03**

Course Objective:

Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents:

Module I: Introduction

Ecology and ecosystem.

Module II: Environmental pollution

Water, soil and air, noise and thermal pollution, their sources and effects.

Module III:Waste water (sewage and industrial effluents) treatments

Anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria- technical process and conditions, emerging biotechnological processes in waste - water treatment.

Module IV: Solid waste management

Landfills, composting, earthworm treatment, recycling and processing of organic residues**.**

Module V:Biodegradation

Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution

Module VI: Microbial leaching and mining

Microbial leaching and mining: Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Module VII:Wasteland

Wasteland: Uses and management, bioremediation and biorestoration of contaminated lands.

Module VIII:Environmental genetics

Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.

Module IX: Hazardous wastes

Hazardous wastes: source management and safety.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Biotechnology by PK Mohapatra

References:

- Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
- BiotreatmentSystems, Vol.22, D. L. Wise (Ed.), CRCPress, INC.
- Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association.

BIOPROCESS PLANT DESIGN

Course Code: BTB 709 **Credit Units: 03**

Course Objective:

The objective of this paper is to include not only the application of chemical engineering principles/unit operations to bioprocess systems but also to include the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I

Introduction; general design information; Mass and energy balance; Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Applied Process Design for Chemical and Petrochemical Plants, E.E. Ludwig, Butterworth-Heinemann
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann
- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling, F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design, E. Bausbacher and R. Hunt, Prentice Hall PTR.

ARTIFICIAL NEURAL NETWORKS

Course Code: BTB 710 **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, beides the closely related aspects of artificial neural networks.

Course Contents:

Module I

Historical background, Why is learning hard?

Module II

Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multi-layer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning,

Module III

The backpropagation algorithm, Aspects of Learning Theory and Generlization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?

Module IV

Neural networks and analog VLSI, Selected Applications

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Neural Networks: A Comprehensive Foundation, S. Haykin, Prentice Hall
- Neutral Networks for Pattern Recognition, C. Bishop, Oxford University Press

ADVANCED JAVA PROGRAMMING

Course Code: CSE 504 **CreditUnits: 03**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Course Contents:

Module I (5 Hours)

Introduction to Java RMI, RMI services, RMI client, Running client and server, Introduction of swing, swing components, Introduction to Multimedia Programming

Module II (5 Hours)

Database Connectivity using JDBC- Understanding JDBC, Define the layers in JDBC architecture, various types of JDBC drivers, manipulating various SQL Queries, Manage transactions and perform batch updates in JDBC, Creating Database Connectivity Applications, Connection to Database with the java.sql Package.

Module III (8 Hours)

Introduction to sever side programming, Introduction to Servlets, Web Container, Servlet Life Cycle, and Servlet based Applications, Servlet and HTML. Web.xml file. Session tracking

Module IV (6 Hours)

JSP: Introduction to JSP, JSP architecture, JSP syntax Basics, JSP implicit objects, JSP based Applications. The Model-View-Controller Architecture. Session management.

Module V (6 Hours)

Enterprise Java Beans:-EJB roles—EJB Client-Object -container-Transaction Management—implementing a Basic EJB Object-Implementing session Beans-Implementing Entity Beans-Deploying an enterprise Java Beans Object-Changes in EJB1.1 specification.

Examination Scheme:

Components	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
- Professional Java Server Programming (a Press) By Allamaraju
- Developing Java Servlets (Techmedia – SAMS) By James Goodwill
- Using Java 1.2 Special Edition (PHI) By Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, "JAVA 2" PEARSON publication

Course Outcomes:

The student will learn

- Can develop Java Applets, Beans programming.
- Can Understand Advanced Java Networking concepts and develop server side application.
- Can learn Server Side Programming Concepts and create Dynamic web Application.
- Know about the JDBC Principles and can interact with back end database with java programming.
- Understand the application server and also understand the enterprise level applications.

BIOPROCESS TECHNOLOGY LAB

Course Code: BTB 720 **Credit Units: 01**

Course Contents:

Module I
Isolation of industrially important micro organisms for microbial processes.

Module II
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer

Module III
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module IV
Comparative studies of ethanol production using different substrates.

Module V
Production of single cell protein

Module VI
Production and estimation of alkaline protease

Module VII
Sauer Krant fermentation

Module VIII
Use of alginate for cell immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

DOWNSTREAM PROCESSING LAB

Course Code: BTB 721 **Credit Units: 01**

Course Objective:

The laboratory will help the students to extract different bioproducts during their characterization since any of these products may be of biotechnological importance. They can be exploited in exploring the future biotechnology.

Course Contents:

Module I
Conventional filtration and membrane based filtration

Module II
Protein precipitation and recovery

Module III
Aqueous two-phase separation

Module IV
Ion exchange chromatography

Module V
Gel Permeation chromatography

Module VI
Electrophoresis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

ADVANCED JAVA PROGRAMMING LAB

Course Code: CSE 524 **CreditUnits: 1**

Course Objective:

The objective is to equip the students with the advanced feature of contemporary java which would enable them to handle complex programs relating to managing data and processes over the Enterprise network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Programming Language: Java

23. Implement two services that should be run on a given network host. You should use JavaRMI. Develop a basic arithmetic calculator with the help of java RMI.
24. Write a Java program that can create an employee form for inserting the detail of employee in an organization by using Applets create a JFrame which have labels, text box, Radio button, Check Box, button etc.
25. For the above form write a programme to handle the events for checking the data input by user.
26. WAP that implement a JApplet and display the following frame
    a. Customer name
    b. Customer number
    c. Age
    d. Address
27. Write a Java program to access a table Employees for Oracle Sample database in HR Schema using Java code.
28. Write a Java program to manipulate a table Employees for Oracle Sample database in HR Schema using Java code.
29. Write a Java program that implement a simple servlet program.
30. Write a Java program for authentication,
    g). Create the Web Page for User-Name and Password
    h). Validate the login-id and password by the servlet code.
    i). Connecting a database using user-id and password.
31. Write a Java program to product selling web site
    e) Read data send by the client (HTML page)
    f) Insert data into the database using the prepared statement.
    c). Display the output to client for item purchased or not.
32. Write a Java program to include a HTML page into a JSP page to product purchasing.
    g) Read data send by the client (HTML page)
    h) Insert data into the database using the prepared statement.
    c). Display the output to client for item purchased or not.
33. Write a Java program using Enterprise Java Beans for creating an application
    k) Adding a Session EJB component to handle the business logic of the J2EE Application.
    l) Integrating the DAO into the Session EJB.
    m) Adding an Entity EJB
    n) Integrating the Entity EJB into the Session EJB.
    o) Interfacing the Web Tier with the Session EJB.

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS) By Jamie Jaworski
- Professional Java Server Programming (a Press) By Allamaraju
- Developing Java Servlets (Techmedia – SAMS) By James Goodwill
- Using Java 1.2 Special Edition (PHI) By Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell- A desktop Quick reference -O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- Jaison Hunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, “JAVA 2” PEARSON publication

Course Outcomes:

- Ability to design and develop Java Applets, Beans programming.
- Ability to design and structure the Server Side Programming Concepts.
- Ability to Create and design Dynamic web Application.
- Write the structured code for JDBC (back end database).
- Ability to develop and design the enterprise level applications.

COMMUNICATION SKILLS-VII

Course Code: BCU 741 **Credit Units: 1**

Course Objective:

The course is designed to empower students to carry out day to day communication at the work place by adequate understanding of various types of communication to facilitate efficient interpersonal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Meetings**	**30% Weightage**
	• Notices • Circulars • Agenda • Minutes	
2.	**odule II Report Writing & Telephony Skills**	**25% Weightage**
	➢ **Report Writing** • Purpose/Significance • Types • Format ➢ **Telephony Skills** • Call Receiving/ Handling/ Concluding Etiquette • Voice Modulation • Effective Listening • Dos and Don'ts of Telephony Skills	
3.	**Negotiation Skills** • Definition/Concept • Purpose/ Significance • Checklist- Good & Bad Practices	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• The Great Trial-Robert Payne • The Home Coming - Rabindra Nath Tagore • How Much Land does a Man Need? - Leo Tolstoy • Valiant Vicky, The Brave Weaver - Flora Anne Steel All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
7.	**Student Learning Outcomes:** • Conduct all business activities related to the workplace with technical efficiency. • Contribute positively to the overall growth of the organization.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
T.N Chabbra , Business Communication , Sun India Publication.

Sanjay Kumar & Pushplata , Communication skills , Oxford University Press.

Reference: *Jones, Working in English, First Edition, Cambridge, CUP, 2001.*
AdditionalReading:NewspapersandJour

Behavioural Science - VII

Course Code: BSU-743 **Course Credit: 01**

Total Hours: 10

Course Objective

This course will help the students to:

- Explore interest and attitude
- Explore career opportunities
- Set career goals
- Developing attributes that employers value

Course Contents:

Module I: Career Planning **(2 Hours)**

- Importance of Career Planning & Development
- Career Development Plan
- Assessment of Career Development

Module II: Career Success: Interest, Aptitude & Attitude (Personality) **(2 Hours)**

- Interest, Aptitude & Attitude
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude

Module III: Explore Career for Growth **(2 Hours)**

- Selecting from available resources
- Career selection (Jobs)
- Career planning and development

Module IV: Self Reliance and Employability skills **(2 Hours)**

- Self awareness, Self promotion and Presentation, Self confidence
- Action planning, Networking, Negotiation
- Political awareness, Coping with uncertainty,
- Developing positive attributes at work place (personal and professional)
- Time Management as Self Management

Module V: Impression Management for Career Enhancement **(2 Hours)**

- Meaning & Components of Impression Management
- Impression Management Techniques(Influencing Tactics)
- Impact of Impression Management on Career Planning and Development

Student learning outcomes

- Students develop the ability to identify suitable career options and to create a suitable career plan based on the utilization of the counseling process, assessment tools, and other resources.
- Students will know how to assess their skills, interests and values.
- Students will know how to make informed career choices based on their self- assessment.
- Students will know how to explore relevant career options and build skills pertinent to those of greatest interest.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-VII

CourseCode:FLU744 **Creditunits:02**

CourseObjective:

Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable

- Todescribe anobject, compare objectsandevaluate
- Toaskforinformation, precision
- Tomake claims

CourseContents:

Dossier2–pg17-28,Dossier2:64millionsde consommateursActesdeCommunication:

Décrireunobjet(unbijouunique,unvoyageextraordinaire,unnouvelappareil photo)
Évaluerune chose (acheteruncadeau,discuterleprix)
Ouvriruncompteà la banque (demanderdesrenseignementsaubanquierafind'ouvriruncompte)
Demanderdes informations/précisions(précisionssurunproblème danslerelevéde compte)
Faire uneréclamation(s'adresserauservice après-vente pouréchangerunproduit défectueux)

Thèmesabordés:

S'habillerbonmarché (commentvoushabillez-vousbonmarché ?)
Le e-commerce (le portrait del'e-acheteurde votre pays)
Lesproduitscontrefaits(parlerdesproduitscontrefaits)
Laprofession:Lesmaraîchers(débats:commentéviterlegaspillage?lamodedeviedesdécroissants,privilégie-t- onla qualité oule prixlorsd'unachat?)

Grammaire :

13. Le pronom " en "
14. Laplace de l'adjectif
15. Le présent progressif
16. Le passé récent
17. Le futurproche(révision)
18. Le comparatifet le superlatif

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

SUMMER PROJECT - II

Course Code: BTB 760 Credit Units: 06

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report.
(Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.8 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.8.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.8 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50

Total:

GENOMIC AND PROTEOMICS

Course Code: BTB 801 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics.

Course Contents:

GENOMICS

Module I: Genome Evolution

Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).

Module II: Structural Genomics

Chromosome structure and Genome organization, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.

Module III: Comparative Genomics

Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.

Module IV: Functional Genomics

ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools

Module V: Genotyping Background and Applications.

Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.

PROTEOMICS

Module VI: Fundamentals of Proteomics

Proteomics Basics and 2D Gel Electrophoresis,

Protein Identification and Analysis:

a. Protein preparation and Separationb. Protein Identification by mass spectrometryc. Identification of post translation modification

Protein Expression Mapping,High-throughput cloning of ORFs,Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease.

Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- Biotechnology and Genomics by P.K.Gupta

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
- DNA : Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

DRUG DELIVERY SYSTEMS

Course Code: BTB 802 **Credit Units: 03**

Course Objective:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)

Module III: Drug administration

Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery.

Current technologies and new and emerging technologies in oral delivery

Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

MANAGEMENT ACCOUNTING AND COST CONTROL

Course Code: BCH 621 **Credit Units: 01**

Course Objective:

The course aims to develop an understanding of the importance, language and techniques of Financial, Cost and Management accounting, skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making. Student should be able to understand the basic concepts of Company accounts with reference to the Indian context.

Course Contents:

Module I

Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements

Module II

Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application

Module III

Variable and Absorption costing, Job-Costing and Process-Costing Systems,

Module IV

Tools for planning and control, Master budget, Flexible Budgets and Variance analysis

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cost Accounting, C.Horngreen, Prenctice Hall
- Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

- Management Accounting, C. Horngreen, Prenctice Hall

PROJECT MANAGEMENT

Course Code: BCH 622 **Credit Units: 01**

Course Objective:

The course aims atmaking an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process. Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Course Contents:

Module I: Introduction
Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure

Module II: Project Training
Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.

Module III: Project initiation
Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control

Module IV: Managing Risk
Risk Management Process: Risk Identification, Risk Assessment.
Risk Response Development: Risk Response Control

Module V: Project Termination
Project Auditing and Termination

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:
- Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business.

ASP .NET

Course Code: CSE 804 | **Credit Units: 03**
Total Hours: 30

Course Objective:
To create web based applications using ASP.NET and c#. Learns to create window based applications

Course Contents:

Module I: Introduction to .NET technologies (6 Hours)
Features of .NET, .NET Framework, CLR, MSIL, .NET class library, .NET Languages, CTS, assemblies, manifest, and metadata, What is ASP.NET?, Difference between ASP and ASP.NET.

Module II: Controls in ASP.NET (6 Hours)
Overview of Dynamic Web page, Understanding ASP.NET Controls, Applications, Web servers, Installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, validation Controls: Required Field Comparison Range. Calendarcontrol, Ad rotator Control, Internet Explorer Control.

Module III: Overview of ADO.NET and XML(8 Hours)
What is ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets , using Command & Data Reader, binding data to data bind Controls, displaying data in data grid, XML basics, attributes, fundamental XML classes: Document, text writer, text reader. XML validations, XML in ADO.NET, The XML Data Document.

Module IV: ASP.NET Applications(6 Hours)
Creating, tracking, caching, error handling, Securing ASP.NET applications- form based applications, window based application.

Module V: Web services(4 Hours)
Introduction, State management- View state, Session state, Application state, Building ASP.NET web services, working with ASP.NET applications, creating custom controls.

Course Outcomes:
The student will learn
- Develop dynamic web applications, create and consume web services
- Use appropriate data sources and data bindings in ASP.NET web applications
- Research and discover information about current topics, illustrate in an example, and present to the class.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**ESE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- ASP.NET Unleashed by Stephen Walther, SAMS publications

References:
- ASP.NET, Wrox Publications
- ASP.NET and VB.NET, Wrox Publication
- ASP.NET and C#.NET, Wrox publication.

GENOMICS AND PROTEOMICS LAB

Course Code: BTB 820 **Credit Units: 01**

Course Contents:

Module I

Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods

Module III

Gene finding tools and Genome annotation

Module IV

Comparison of two given genomes

Module V

Analysis of 2D – IEF data

Module VI

Microarray and Microarray data analysis

Module VII

Inference of protein function from structure

Module VIII

Inference of protein function and structure

Module IX

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ASP.NET LAB

Course Code: CSE 824 **Credit Units: 01**
Total Hours: 20

Course Objective:
This course is designed to provide the knowledge of Dot Net Frameworks along with C#

Software Required: Visual Studio and SQL server

Topics covered in lab will include the following Programs:

- Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
- Write a simple ASP.NET program to display the following Web Controls:

7. A button with text "clicks me". The button control must be in the center of the form.
8. A label with a text hello.
9. A checkbox.

- The form name must be Web Controls
- Write a program to display "Welcome To Radiant" in the form when the "click" button is clicked. The form title must be ASP.NET.

IV. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.

- Write a program containing the following controls:

9. A ListBox
10. A Button
11. An Image
12. A Label

The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

VI. Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.

VII. Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.

VIII. Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.

IX. Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.

X. Check the length of the string in the TextBox using CustomValidator.

Course Outcomes:
After completion of the course the student will be able to use the features of Dot Net Framework along with the features of C#

Examination Scheme:

IA				**EE**	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

COMMUNICATION SKILL – VIII

Course Code: BCU 841 **Credit Units: 1**

Course Objective:
This course is designed to hone the creative minds of students to develop knowledge of diverse ethnic groups and cultures and to increase self-awareness for cultural competence and sensitivity.
Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Speaking in Public** • Essentials in Public Speaking • Parameters of Public Speaking	**45% Weightage**
2.	**Module II Cross Cultural Communication** • Culture and Context • Awareness & Significance of Understanding Culture • Ethnocentrism, Stereotyping and Cultural Relativism • Cultural Shock and Social Change	**45% Weightage**
3.	**Module III Prose**	**10% Weightage**
4.	• India Cinema: Tradition & Change-Chidananda Das Gupta • Kabuliwala-Rabindranath Tagore • The Duchess and the Jewelller -Virginia Woolf • The Park- James Mathews All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
	Student Learning Outcomes: • Students will be able to navigate cross cultural encounters in a global economy. • Facilitate students to develop learning to construct and deliver messages that incorporate the appropriate use of organizing content, language, vocabulary, kinesics, eye contact, appearance, visual aids, and time constraints.	
5.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
6.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Penrose, Rasberry & Myers. Business Communication for Managers: An Advanced Approach, New Delhi: Cengage, 2012.*
Raman, Meenakshi. Business Communication, Oxford
Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011
References:
Beamer, Linda. Intercultural Communication in the Global Workplace, Irwin/McGraw-Hill, 2005.
Reynolds, Sana & Deborah Valentine. Guide to Cross-cultural Communication, Prentice Hall, 2003.
Additional Reading: Newspapers and Journals.

Behavioural Science – VIII

Course Code: BSU-843 **Course Credit:01**
Total Hours: 10

Course Objective:

- To have a great deal of insight into one's character.
- Understanding of positive emotions
- To explore the dimensions of happiness, well-being, Optimism and hope
- Quick understanding of different situations and grasp new concepts.

Course Contents:

Module I: Positivity in personality **(2 Hours)**

- Importance of Positivity in personality
- Positivity Vs. Negativity
- Introspection and personal growth

Module II: Positive Emotions **(2 Hours)**

- Understanding positive emotions
- Importance of Positive emotion
- Types and identification of positive emotions (Love, happiness, Contentment, Resilience, etc.)

Module III: Hope, Optimism and Resilience **(2 Hours)**

- Positive approach towards future
- Benefits of Positive approach
- Resilience during challenge and loss

Module IV: Application of Positive Emotions **(2 Hours)**

- Application of positive emotions in relationships, and organizations
- Creating healthy organizational climate
- Positive emotions enhances performance.
-

Module V: Happiness and Well Being **(2 Hours)**

- Concept of Happiness & Well-Being
- Secret of happy mind and healthy life
- Work life balance.

Student learning outcomes:

Students develop the ability to identify and regulate positive emotions for personal and professional excellence.

- Students will know how to develop resilience.
- Students will know how to role of happiness to attain wellbeing.
- Students will know how to nurture personality by positivity.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan D. (2005). Information and Knowledge Management Macmillan India Ltd. Delhi.

Français-VIII

CourseCode:FLU844 **Creditunits:02**

CourseObjective:
Toprovide the studentswiththelinguistictoolstoenhance socialcommunicationskillsand beable

- Toexpressanintention, announce a news, enquireaboutanevent
- To speakaboutthe future
- Todiscussthemedia

CourseContents:
Dossier3–pg29-40,Dossiers1&2(révision). Dossier3:Médias.frActesdeCommunication:
Parlerdel'avenir(lesavantageset lesinconvénientsdesréseauxsociaux)
Exprimeruneintention(poserdesquestion ssurunforum) Parlerdesmédias
Engager/ terminerune conversation(demanderpourquoionn'a pasréponduaumèl)
Interrogersurunévénement (vol,accident)
Annoncerunenouvelle (celle de démission)
Thèmesabordés:
LesFrançaiset la presse (débat: Croyez-vousauxlégendesurbaines?)
LesFrançaisetInternet(débat:lesinformationsdelapresseécritesontplusfiablesquelesinformationss urInternet ?)
LatélévisiondesFrançais
Laprofession: Lesanimateursradio(débat : pouroucontre le téléchargement illégal de la musique oudesfilms)
Grammaire :
9. Le futursimple
10. L'hypothèse surlefutur
11. Lesformesde la négation
12. Lespronomscomplémentsdirectset indirects (révision)

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:

- Carenzi-Vialaneix,Christelle et al. A proposA2Livre de l'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Carenzi-Vialaneix,Christelle et al. A proposA2Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,BrunoetMous,Nelly.Réussir leDELFA1.Paris:LesÉditionsDidier,2010.

MAJOR PROJECT

Course Code: BTB 860 **Credit Units: 16**

Course Objective:

The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 **Abstract** and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

➢ Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

➢ Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

➢ Abstract

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

➢ Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

➢ Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➢ Review of Literature and Definition of Problem

➢ Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.9 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.9.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.9 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	100
Viva Voce:	100
Total:	**200**

AMITY UNIVERSITY

M A D H Y A P R A D E S H

Bachelor of Science (Honours) Biotechnology

Programme Code: BSB

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2020 -2023

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2019

PROGRAMME OBJECTIVE

B. Sc. (H) Biotechnology aims to develop highly specialized hard core specialization in various diversified areas of biotechnology and its application to medicine, agriculture, environment, nutraceuticals and functional food etc.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research orientated project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practical conducted in well equipped laboratories in the area of Biotechnology, Animal Biotechnology & Immunology. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biotechnology.

PROGRAMME STRUCTURE

FIRST SEMESTER

Compulsory Courses							
Old Course Code	**New Course Code**	**Course Title**	**Lecture (L) Hours Per week**	**Tutorial (T) Hours Per week**	**Practical (P) Hours Per week**	**Total Credit**	**Page No.**
BSB 101	BSB 101	Cell Biology	3	-	-	3	
BSB 102	BSB 102	Maths& Biostatistics	3	-	-	3	
BSB 103	BSB 103	Plant Sciences – I	3	-	-	3	
BSB 104	BSB 104	Animal Sciences-I	3			3	
BSB 105	BSB 105	Chemistry – I	3	-	-	3	
BSB 120	BSB 120	Biotechnology Lab - I	-	-	2	1	
BSB 121	BSB 121	Chemistry Lab – I	-	-	2	1	
BSB 122	BSB 122	Plant Sciences Lab - I	-	-	2	1	
BSB 123	BSB 123	Animal Sciences Lab-I			2	1	
BSB 142	EVS 142	Environmental Studies - I		-	-	2	
		TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three (Hours/Sem)							
BSB 141	BCU 141	Communication Skill - I	30	-	-		
BSB 143	BSU 143	Behavioural Science - I	30	-	-		
BSB 144 BSB 145 BSB 146 BSB 147 BSB 148	FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses							
BSB 201	BSB 201	Introductory Biochemistry & Biophysics	3	1	-	4	
BSB 202	BSB 202	Bioanalytical Techniques	3	-	-	3	
BSB 203	BSB 203	Plant Sciences – II	3	-	-	3	
BSB 204	BSB 204	Animal Sciences-II	2	1		3	
BSB 205	BSB 205	Chemistry – II	3	-	-	3	
BSB 220	BSB 220	Biotechnology Lab – II	-	-	2	1	
BSB 221	BSB 221	Chemistry Lab – II	-	-	2	1	
BSB 222	BSB 222	Plant Sciences Lab – II	-	-	2	1	
BSB 223	BSB 223	Animal Sciences Lab-II	-	-	2	1	
BSB 242	EVS 242	Environmental Studies - II	2	-	-	2	
		TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB 241	BCU 241	Communication Skill - II	1	-	-	1	
BSB 243	BSU243	Behavioural Science - II	1	-	-	1	
BSB 244 BSB 245 BSB 246 BSB 247 BSB 248	FLU 244 FLU 245 FLU 246 FLU 247 FLU 248	Foreign Language - II French - II German Spanish Japanese Chinese	2	-	-	2	

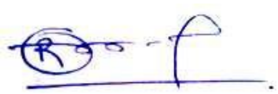
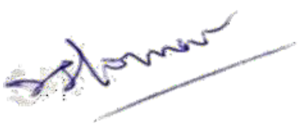
TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses							
BSB 301	BSB 301	Genetics	3	-	-	3	
BSB 302	BSB 302	Microbiology	3	-	-	3	
BSB 303	BSB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BSB 304	BSB 304	Anatomy & Plant Physiology	3	-	-	3	
BSB 305	BSB 305	Animal Physiology-I	2	1	-	3	
BSB 306	BSB 306	Chemistry – III	3	-	-	3	
BSB 320	BSB 320	Biotechnology Lab – III	-	-	4	2	
BSB 321	BSB 321	Chemistry Lab – III	-	-	2	1	
BSB 322	BSB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BSB 323	BSB 323	Animal Physiology Lab-I	-		2	1	
BSB 330	BSB 330	Term Paper (Evaluation)	-	-	-	2	
		TOTAL				**25**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB 341	BCU 341	Communication Skill - III	30	-	-		
BSB 343	BSU343	Behavioural Science - III	30	-	-		
BSB 344 BSB 345 BSB 346 BSB 347 BSB 348	FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses							
BSB 401	BSB 401	Bioinformatics	3	-	-	3	
BSB 402	BSB 402	Molecular Cell Biology	3	-	-	3	
BSB 403	BSB 403	Immunology	3	-	-	3	
BSB 404	BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BSB 405	BSB 405	Animal Physiology-II	3	-	-	3	
BSB 406	BSB 406	Chemistry – IV	3	-	-	3	
BSB 420	BSB 420	Biotechnology Lab - IV	-	-	4	2	
BSB 421	BSB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BSB 422	BSB 422	Animal Physiology Lab-II	-	-	2	1	
		TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB441	BCU 441	Communication Skill - IV	30	-	-		
BSB 443	BSU443	Behavioural Science - IV	30	-	-		
BSB 444 BSB 445 BSB 446 BSB 447 BSB 448	FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses							
BSB 501	BSB 501	Plant Biotechnology	3	-	-	3	
BSB 502	BSB 502	Animal Biotechnology	3	-	-	3	
BSB 503	BSB 503	Immunotechnology	2	-	-	3	
BSB 504	BSB 504	Genomics & Proteomics	3	-	-	3	
BSB 505	BSB 505	Recombinant DNA Technology	3	-	-	3	
BSB 506	BSB 506	Microbial Technology	3	-	-	3	
BSB 520	BSB 520	Biotechnology Lab - V	-	-	4	2	
BSB 521	BSB 521	Genomics & Proteomics Lab	-	-	4	2	
BSB 550	BSB 550	Summer Training (Evaluation)	-	-	-	5	
		TOTAL				**27**	
Optional Courses - Value Added Courses; Any Three							
BSB 541	BCU 541	Communication Skill - V	30	-	-		
BSB 543	BSU 543	Behavioural Science - V	30	-	-		
 BSB 544 BSB 545 BSB 546 BSB 547 BSB 548	 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses							
BSB 601	BSB 601	Environmental Biotechnology	4	-	-	4	
BSB 602	BSB 602	Industrial Biology	4	-	-	4	
BSB 603	BCH 623	Principles of Management & Entrepreneurship Development	1	-	-	1	
BSB 620	BSB 620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BSB 660	BSB 660	Project (10-12 Week)	-	-	-	12	
		TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three (Hrs/Sem)							
BSB 641	BCU 641	Communication Skill - VI	30	-	-		
BSB 643	BSU643	Behavioural Science - VI	30	-	-		
 BSB 644 BSB 645 BSB 646 BSB 647 BSB 648	 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

V. dastal

CELL BIOLOGY

Course Code: BSB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology - Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker , Klinshmith& Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: BSB 102 **Credit Units: 03**

Course Objective:

The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course
Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II
Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III
Measure of central tendency and measure of dispersion
Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution
Simple problems involving Binomial, Poisson and Normal variables,

Module IV
Correlation and regression,
Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:
- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: **BSB 103** **Credit Units: 03**

Course Objective:

The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Course Contents:

Module I: Algae

Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:

Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi

Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:, *Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes

Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes

Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: **BSB 104** **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.
-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:
-Protozoa: Type study of *Plasmodium.*
-Porifera: Type of *Sycon.*

Module III
-Coelnterata: Type study of *Ovelia.*
-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates
-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*
-Arthropoda: Type Study of *Prawn*

Module V:
Mollusca: Type Study of *Pila*
Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: **BSB 105** **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: **BSB 120** **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: **BSB 121** **Credit Units: 01**

Course Contents:
INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2Cr_2O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Plant Sciences - I

Course Code: BSB 122 Credit Units: 01

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Sciences - I

Course Code: BSB 123 Credit Units: 01

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ENGLISH LANGAUGE USAGE ESSENTIALS

Course Code: **BSB 141** **CreditUnits: 01**

Course Objective:

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:

Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication

Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	**A**	**CT**	**HA**	**EE**
Weightage (%)	05	15	10	70

ENVIRONMENTAL STUDIES – I

Course Code: BSB 142 **Credit Units: 02**

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance
Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems
Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem
Structure and function of an ecosystem
Producers, consumers and decomposers
Energy flow in the ecosystem
Ecological succession
Food chains, food webs and ecological pyramids
Introduction, types, characteristic features, structure and function of the following ecosystem:

i. Forest ecosystem
j. Grassland ecosystem
k. Desert ecosystem
l. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels
India as a mega-diversity nation
Hot-spots of biodiversity
Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
Endangered and endemic species of India
Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

UNDERSTANDING SELF FOR EFFECTIVENESS

Course Code: **BSB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and its effect on personality
Building emotional competence

Course Contents:

Module I: Self: Core Competency
Understanding of Self
Components of Self – Self identity
Self concept
Self confidence
Self image

Module II: Techniques of Self Awareness
Exploration through Johari Window
Mapping the key characteristics of self
Framing a charter for self
Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness
Meaning & Importance
Components of self esteem
High and low self esteem
Measuring your self esteem

Module IV: Building Positive Attitude
Meaning and Nature of Attitude
Components and Types of Attitudes
Relevance and Importance of Attitudes

Module V: Building Emotional Competence
Emotional Intelligence – Meaning, Components, Importance and Relevance
Positive and Negative Emotions
Healthy and Unhealthy expression of Emotions

Module VI:End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company

FRENCH - I

Course Code: **BSB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A:pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical :Unité 1: Découvrir la langue française : (oral et écrit)

7. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
8. dire/interroger si on comprend
9. Nommer les choses

Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3 :Organiser son temps

15. dire la date et l'heure

Contenu grammatical :

1. organisation générale de la grammaire
16. article indéfini, défini, contracté
17. nom, adjectif, masculin, féminin, singulier et pluriel
18. négation avec « de », "moi aussi", "moi non plus"
19. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
20. pronom tonique/disjoint- pour insister après une préposition
21. futurproche

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BSB 201 **Credit Units: 04**

Course Objective:

Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Course Contents:

Module I: Nature of Biological materials
carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules
Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic
Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body
Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments
Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:
- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry - Voet&Voit

BIOANALYTICAL TECHNIQUES

Course Code: BSB 202 Credit Units: 03

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Course Contents:

Module I: Instruments, basic principles and usage

pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques

Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis

Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

Plant Sciences - II

Course Code: BSB 203 **Credit Units: 03**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

Animal Sciences - II

Course Code: BSB 204 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: **BSB 205** **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I

Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II

Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III

Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV

Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V

Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin’s Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – II (BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: **BSB 220** **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BSB 221 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH^{1+}, K^{1+}, CO^{2-}, S^{2-}, SO^{2-}, NO^{1-}, CH COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO^{1-}, SO^{2-}, C O^{2-}, PO^{3-}, BO^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: **BSB 222** **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations.

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: **BSB 223** **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear

Different types of important edible fishes of India

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Development of chick up to formation of primitive streak

Module V: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

INTRODUCTION TO COMMUNICATION SKILL

Course Code: BSB 241 CreditUnits: 01

Course Objective:
The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

Course Contents:
Module I: Vocabulary
Use of Dictionary
Use of Words: Diminutives, Homonyms & Homophones
Module II: Essentials of Grammar - I
Articles
Parts of Speech
Tenses
Module III: Essentials of Grammar - II
Sentence Structure
Subject -Verb agreement
Punctuation
Module IV: Communication
The process and importance
Principles & benefits of Effective Communication
Module V: Spoken English Communication
Speech Drills
Pronunciation and accent
Stress and Intonation
Module VI: Communication Skills-I
Developing listening skills
Developing speaking skills
Module VII: Communication Skills-II
Developing Reading Skills
Developing writing Skills
Module VIII: Written English communication
Progression of Thought/ideas
Structure of Paragraph
Structure of Essays
Module IX: Short Stories
Of Studies, by Francis Bacon
Dream Children, by Charles Lamb
The Necklace, by Guy de Maupassant
A Shadow, by R.K.Narayan
Glory at Twilight, Bhabani Bhattacharya
Module X: Poems

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

Examination Scheme:

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

Text & References:
- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, MalraTreece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

ENVIRONMENTAL STUDIES – II

Course Code: BSB 242 Credit Units: 02

Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: Environmental Pollution

Definition

Causes, effects and control measures of:

o. Air pollution
p. Water pollution
q. Soil pollution
r. Marine pollution
s. Noise pollution
t. Thermal pollution
u. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution.
Pollution case studies.
Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment

From unsustainable to sustainable development
Urban problems and related to energy
Water conservation, rain water harvesting, watershed management
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environmental ethics: Issues and possible solutions
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation
Consumerism and waste products
Environmental Protection Act
Air (Prevention and Control of Pollution) Act
Water (Prevention and control of Pollution) Act
Wildlife Protection Act
Forest Conservation Act
Issues involved in enforcement of environmental legislation
Public awareness

Module III: Human Population and the Environment

Population growth, variation among nations
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights
Value Education
HIV / AIDS
Women and Child Welfare
Role of Information Technology in Environment and Human Health
Case Studies

Module IV: Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.
Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
Study of common plants, insects, birds
Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

INDIVIDUAL, SOCIETY AND NATION

Course Code: **BSB 243** **Credit Units: 01**

Course Objective:

To enable the students:
Understand the process of problem solving and creative thinking.
Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving
What is thinking: The Mind/Brain/Behaviour
Thinking skills
Critical Thinking and Learning:
Making Predictions and Reasoning
Memory and Critical Thinking
Emotions and Critical Thinking

Module II: Hindrances to Problem Solving
Perception
Expression
Emotion
Intellect
Work environment

Module III: Problem Solving Process
Recognizing and Defining a problem
Analyzing the problem (potential causes)
Developing possible alternatives
Evaluating Solutions
Resolution of problem
Implementation

Module IV: Plan of Action
Construction of POA
Monitoring
Reviewing and analyzing the outcome

Module V: Creative Thinking
Definition and meaning of creativity
The nature of creative thinking
Convergent and Divergent thinking
Idea generation and evaluation (Brain Storming)
Image generation and evaluation
Debating
The six-phase model of Creative Thinking: ICEDIP model

Module VI:End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Text & References:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

FRENCH - II

Course Code: BSB 244 **Credit Units: 02**

Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
To make them learn the basic rules of French Grammar.

Course Contents:

Module A : pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

7. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
8. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
9. Faire un programmed'activités

imaginer une conversation téléphonique/un dialogue
Propositions- interroger, répondre

Unité 4:Découvrir son environnement

9. situer un lieu
10. s'orienter, s'informer sur un itinéraire.
11. Chercher, décrire un logement
12. connaître les rythmes de la vie

Unité 5: s'informer

9. demander/donner des informations sur un emploi du temps passé.
10. donner une explication, exprimer le doute ou la certitude.
11. découvrir les relations entre les mots
12. savoir s'informer

Contenu grammatical:

1. Adjectifsdémonstratifs
14. Adjectifs possessifs/exprimer la possession à l'aide de :
    A. « de » ii. A+nom/pronom disjoint
15. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
16. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
17. passé composé
18. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

GENETICS

Course Code: BSB 301 Credit Units: 03

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Course Contents:

Module I
Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II
Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III
Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV
Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V
Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI
Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII
Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: BSB 302 Credit Units: 03

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery, origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Course Contents:

Module I: History and development of microbiology
Introduction, contribution of Scientists (Leeuwenhoek, Pasteur, Koch etc.), role of microorganisms in transformation of organic matter and in the causation of diseases. Pasteur's experiments, concept of sterilization, microscopy (optical, TEM and SEM), concept of microbial species and strains; general outline of various forms of micro-organisms.

Module II: Ultra Structure of Prokaryotic cell
Nature of the microbial cell surface, Prokaryotic structure and function - cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions, gram positive and gram negative bacteria and endospores.

Module III
Nutritional classification of microorganisms, isolation of auxotrophs (replica plating), analysis of mutations in biochemical pathways, microbial assays for vitamins and antibiotics, strain improvement by selection.

Module IV: Control of microorganisms
Methods of sterilization & disinfection (Physical agents &chemical agents)Antibiotics with special reference to antibacterial & antifungal antibiotics, mode of actions,drug resistance .

Module V: Microbial agents of diseases
Clinically important Bacterial & fungal diseases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **BSB 303** **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

ANATOMY & PLANT PHYSIOLOGY

Course Code: **BSB 304** **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Course Contents:

Module I
Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviour of cambium in *Achyranthes*, *Boerhaavia*, *Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II
Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III
Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV
Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: **BSB 305** **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSB 306 **Credit Units: 03**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III
(BASED ON GENETICS, MICROBIOLOGY, AND BIOCHEMISTRY AND METABOLIC REGULATION)

Course Code: BSB 320 **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation

Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human

Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.

Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.

Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BSB 321 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO^{2+} as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: **BSB 322** **Credit Units: 01**

Course Contents:

Module I: Physiology
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.
Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.
Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)
Experimentation- Separations of photosynthetic pigments by thin layer chromatography.
Respiration – Determination of R.Q.
Module II: Plant Anatomy
Anatomy of normal dicot and monocot roots, stems & leaves
Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSB 323 **Credit Units: 01**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*
K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar &Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

BehaviouralScience–III

CourseCode:BSU-343 CourseCredit:01

Course Objective:

To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:

- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking

- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:

- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking

- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

ExaminationScheme:

EvaluationComponents	Attendance	JournalofSuccess(JOS)	SocialAwarenessProgram(SAP)SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

SuggestedReadings:

- Michael Steven:Howto bea betterproblem solver,Kogan Page, NewDelhi, 1999
- GeoffPetty:Howto be betteratcreativity; Kogan Page, NewDelhi, 1999
- RichardY. Chang and P. Keith, Kelly:Wheeler Publishing,NewDelhi, 1998. •Phil Lowe KogePage:Creativityand Problem Solving, NewDelhi, 1996
- JWilliamPfeiffer(ed.)TheoriesandModelsinAppliedBehaviouralScience,Vol3,Management(1996); Pfeiffer&Company
- Bensley,AlanD.:CriticalThinkinginPsychology–AUnifiedSkillsApproach,(1998),Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Creditunits:02**

Course Objective:

Toenablethestudents

- totalkaboutthequalitiesanddefectsofpeople.
- toask/give directions,toenquireaboutalodging.
- toaskandgiveinformationaboutacertainplace.
- todescribeeventsinpasttense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parlerdesqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,sesituerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage,
sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerlasatisfactionetl'insatisfaction.

Grammaire :

11. lesadjectifsdémonstratifs
12. lesverbes:'irgroupe'devoir,falloir
13. lesprépositionsdelieu,depays
14. l'impératif,lepassécomposé,formeet accordduparticipepassé,lanégationaupassécomposé
15. lesindicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineetal.A proposA1Livre del'élève.Grenoble:PressesuniversitairesdeGrenoble,2010.
- Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:PressesuniversitairesdeGrenoble,2010.

Références:

- Girardeau,BrunoetNellyMous.RéussirleDELFA

TERM PAPER

Course Code: BSB 330 Credit Units: 02

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject. The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

13. Choosing a subject
14. Finding sources of materials
15. Collecting the notes
16. Outlining the paper
17. Writing the first draft
18. Editing & preparing the final paper

13. Choosing a Subject

The subject chosen should not be too general.

14. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

15. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

16. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

17. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is.

You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

18. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

21) Title page
22) Acknowledgement
23) Abstract
24) Table of contents
25) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
26) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
27) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
28) Results (If any)
29) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
30) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

i) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[5] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C.” Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network” IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[6] Shazia Karim, Imran Sarwar Bajwa,”Clinical Decision Support System based Virtual Telemedicine”2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada “Intelligent Management of Processes in a ICU Telemedicine System” Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts,) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: (Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)	40%
Final Evaluation: (Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)	60%

BIOINFORMATICS

Course Code: BSB 401 **Credit Units: 03**

Course Objective:

The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Course Contents:

Module I: Computers

General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics

Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases

Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.
Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification.

Module V: Genome analysis

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:

- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: **BSB 402** **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic informations are stored, expressed and transmitted among generations.

Course Contents:

Module I: Introduction to Moleculer Biology,

Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.

Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.

Module II:Insertion elements, transposons and retrotransposons

Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.

Application of genetic engineering

Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes

Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.

Module III: Structure of prokaryotic and eukaryotic genes

Transcription mechanism in prokaryotes and eukaryotes.

Translation : Translation mechanisms in prokaryotes and eukaryotes.

Module IV: Gene Expression in prokaryotes

Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)

Module V:Eukaryotic geneExpression

Overview of gene expression, polyadenylation, cap formation, RNA degradation.

Module VI: Oncogenes and Tumor Suppressor genes

Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY

Course Code: BSB 403 **Credit Units: 03**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I
Historical perspective of immune system and immunity; Innate and specific immunity.

Module II
Humoral immunity and Clonal selection theory;

Module III
Cell-mediated immunity.

Module IV
The organs and cells of the immune system.

Module V
Histocompatibility: structure of MHC class I, II & III antigens & their mode of antigen presentation, MHC restriction; Antigens & antigenicity;

Module VI
Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:
- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Course Contents:

Module I
Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.
Module II
Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding
Module III
General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.
Module IV
Economic importance with special reference to plants yielding:
i) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
j) Common fibre yielding plants - Cotton, Jute .
k) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
l) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:
- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BSB 405 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals

- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:

- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:

- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization
-

Module IV:Developmental Biology:

- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: **BSB 406** **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic & non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates
Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II
General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III
General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV
Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics
Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry
Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry
Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY – IV LAB
(BASED ON BIOINFORMATICS, MOLECULAR CELL BIOLOGY, IMMUNOLOGY)

Course Code: BSB 420 **Credit Units: 02**

Course Contents:

Module I: Computers
Handling of computers and Data analysis using Oracle (create, append, delete, pack, display, list count, set, order, index, sort)

Module II: Bioinformatics
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.

Module III
Isolation of nuclear DNA (genomic & plasmid DNA)

Module IV
Blood film preparation &identification of blood cells
Study of blood groups
Study of ELISA.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSB 421 **Credit Units: 01**

Course Contents:

Module I: Embryology
Study of permanent slides of the**:**
m) T.S. anther, pollen, germinating pollen
n) L.S. ovule types
o) Endosperm
p) Embryos
q) L.S. caryopsis
r) Dissection of embryo

Module II:Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code:BSB 422 **Credit Units: 01**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland

- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.

- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- IsmatChughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text:*Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: *Brusaw, Charles T., Gerald J. Alred& Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.*

Additional Reading: Newspapers and Journals.

BehaviouralScience-IV

CourseCode:BSU-443 **CourseCredit:01**
TotalHours:10

CourseObjective:
This course aims at imparting an understanding of Values, Ethics& Moralityamongstudents formakinga balanced choice between personal& professional development.

CourseContents:

ModuleI:IntroductiontoValues&Ethics **(2Hours)**
Meaning & itstype
Relationship between Valuesand
Ethics Its implication inone's life

ModuleII:ValuesClarification&Acceptance **(2Hours)**
CoreValues-Respect, Responsibility, Integrity, Resilience,Care,&
Harmony Its process-SelfExploration
Nurturing Goodvalues

ModuleIII:Morality **(2Hours)**
Difference
betweenmorality,ethics&values
Significance ofmoralvalues

ModuleIV:EthicalPractice **(2Hours)**
Ethical Decisionmaking
Challenges in its
implementation
Prevention
ofCorruption&Crime

ModuleV:Personal&ProfessionalValues **(2Hours)**
Personal values-Empathy,honesty, courage,
commitment Professional Values-Work ethics,
respect for others
Its role in personalitydevelopment Character building- New-self awarness

Studentlearningoutcomes

- Able to answerthe question: WhatdoIstand for?
- Abilitytoapplya coherentsetof moralprinciples within professional andspecialized contexts
- Willingto make unpopularbut right decision
- Committed toworkingfor justiceand peacelocallyand globally.

ExaminationScheme:

EvaluationComponents	Attendance	JournalofSuccess (JOS)	SocialAwarenessProgram(SAP) SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

Text&References:

Cassuto Rothman, J. (1998). Fromthe FrontLines, Student Casesin Social Work Ethics.NeedhamHeights, MA: Allyn and Bacon.
Gambrill, E. &Pruger,R. (Eds). (1996).Controversial Issues in Social Work Ethics, Values, & Obligations. NeedhamHeights, MA:Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthelanguage ofthestudent’sinbothoralandwritten

Torevisethe grammarinapplicationandthecommunicationtasksrelatedtotopicscoveredalready

Togetacquaintedwiththecurrent socialcommunicationskills,oral(dialogue,telephoneconversations,etc.)and writtenandperformsimplecommunicationtaskssuchas

- talkingaboutpersonalhabits
- narratingeventsinthepast,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’ exprimer

autéléphone,demanderetdonnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionoraleet écrite.

Grammaire :

7. l’imparfait,
8. lacomparaisonduverbe/dunom ; mieux/meilleur
9. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:

Text:

Le livre àsuivre:

Andant,Christineetal.A proposA1Livre del’élève.Grenoble:PressesuniversitairesdeGrenoble, 2010.

Andant,Christineetal.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,BrunoetNellyMous.RéussirleDELFA1.Paris: Didi

PLANT BIOTECHNOLOGY

Course Code: BSB 501 **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micropropagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: **BSB 502** **Credit Units: 03**

Course Objective:

The aim of the course is to provide equal importance to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Module I
Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines.

Module II
Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module III
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF,erythropoietin).

Module IV
Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication.

IMMUNOTECHNOLOGY

Course Code: **BSB 503** **Credit Units: 02**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to mankind.

Course Contents:

Module I
Immunoglobulin gene: genetic basis of reation of antibody diversity; Effect of T cell functions.

Module II
Measurement of antigen – antibody interaction: agglutination, immunodiffusion, immuno-electrophoresis, ELISA, RIE, production of monoclonal antibodies.

Module III
Antibodies in targeting therapeutic agents.

Module IV: Hybridoma Technology
Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application

Module V
Tissue and organ transplant

Module VI
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination.
Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman.

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company.
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins.
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

GENOMICS& PROTEOMICS

Course Code: BSB 504 **Credit Units: 02**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Course Contents:

GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome : 2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BSB 505 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Course Contents:

Module I

Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II

Methods of DNA Introduction into living cells.

Module III

Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV

Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V

Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.

PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene cloning and DNA analysis by T.A. Brown

References:

- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

MICROBIAL TECHNOLOGY

Course Code: BSB 506 **Credit Units: 03**

Course Objective:

The basic knowledge of Microbiology gained in the previous semester would the applied in the various disciplines like evolution, Immunology & Industrial fermentation**.**

Course Contents:

Module I

Microbial nutrition and growth -The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module II

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module III

Host-parasite relationship (Normal micro flora of skin, oral cavity, gastrointestinal tract), types of toxins (Exo, endo, entero) and their structure and mode of actions, Microbe Interactions with other populations.

Module IV

Microbes in extreme environments: Archae as the earliest forms, thermophiles, pyshrophiles, halophiles, alkalophiles, acidophiles , hyperthermophiles.

Module V

Introduction to industrially important microbes and microbial fermentative products (Production of antibiotics with special refernce to penciliin& streptomycin, enzymes, biotransformation of steroids), food products from microbes (Dairy &SCP etc)

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

BIOTECHNOLOGY LAB – V(BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BSB 520 **Credit Units: 02**

Course Contents:

Module I

Sterilization techniques of glass wares &equipments.
Preparation of cotton plugs & culture media .
Preparation and sterilization .of different explants.
Inoculation of explants on culture media.

Module II

Culture of plant embryos/seeds.Callus culture, Testing of seed viability.

Module III

Culture of animal cell line.Preparation of competent cells by calcium chloride method.

Module IV

Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD &*E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BSB 521 **Credit Units: 02**

Course Contents:

Module I

Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II

Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III

Comparison of two given genomes- Mummer.

Module IV

Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

<table>
<tr><td colspan="3">Course Contents / Syllabus:</td></tr>
<tr><td>1.</td><td>Module I Vocabulary</td><td>35% Weightage</td></tr>
<tr><td></td><td>• Define Vocabulary
• Significance of Vocabulary
• One Word Substitution, Synonyms & Antonyms and Idioms & Phrases
• Define and Differentiate Homonyms, Homophones and Homographs
• Vocabulary Drills
• Foreign Words</td><td></td></tr>
<tr><td>2.</td><td>Module II Comprehension Skills</td><td>25% Weightage</td></tr>
<tr><td></td><td>• Reading Comprehension-SQ3R Reading Techniques
• Summarising and Paraphrasing
• Précis Writing
• Listening Comprehension</td><td></td></tr>
<tr><td>3.</td><td>Module III Presentation Skills
• Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills.
• Analyzing the Significance of Non-Verbal Communication</td><td>30% Weightage</td></tr>
<tr><td>4.</td><td>Module IV Prose
• How Far is the River-Ruskin Bond
• My Wood-E.M.Forster
• I have a Dream-Martin Luther King
• Spoken English and Broken English-G.B. Shaw</td><td>10% Weightage</td></tr>
<tr><td>5.

6.</td><td>Student Learning Outcomes:
• Communicate fluently and sustain comprehension of an extended discourse.
• Demonstrate ability to interpret texts and observe the rules of good writing.
• Prepare and present effective presentations aided by ICT tools.
Pedagogy for Course Delivery: Workshop
• Group Discussions
• Presentations
• Lectures</td><td></td></tr>
<tr><td>7.</td><td>Assessment/ Examination Scheme:
<table>
<tr><td>Theory L/T (%)</td><td>Lab/Practical/Studio (%)</td><td>End Term Examination</td></tr>
<tr><td>100%</td><td>NA</td><td>70%</td></tr>
</table>
Theory Assessment (L&T):
<table>
<tr><td>Components (Drop down)</td><td>CIE</td><td>Attendance</td><td>End Term Examination</td></tr>
<tr><td>Weightage (%)</td><td>25%</td><td>5%</td><td>70%</td></tr>
</table></td><td></td></tr>
</table>

Text:Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

CourseCode:BSU-543 **CourseCredit:01**
TotalHours:10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

EvaluationComponents	Attendance	JournalofSuccess(JOS)	SocialAwarenessProgram(SAP)SAPReport/SAPPresentation	EndSemesterExam	Total
Weightage(%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann&Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**
CourseObjective:
Tostrengthenthelanguage ofthestudent'sinbothoralandwritten
Torevisethe grammarinapplicationandthecommunicationtasksrelatedtotopicscoveredalready
Togetacquaintedwiththecurrent socialcommunicationskills, oral (dialogue, telephoneconversations,etc.)Andwrittenandperformsimplecommunicationtaskssuchas

- narratingeventsinthepast,markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriatelogical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivreensemble
ActesdeCommunication:
Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,
l'écologie,identifieretdécrirelesdifférencesdecomportement,décrirele fonctionnementd'uneassociation,fairelabiographied'une personne.
Dossiers4, 5,6–Révision
Exercicesd'écoute,productionoraleet écrite.
Grammaire :
9. le présent (révision),lepassécomposé(révision)
10. lespronomscomplémentsdirects,lespronomscompléments indirects
11. lesmarqueurschronologiques
12. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:
Le livre àsuivre:
· Andant,Christineetal.A proposA1Livre del'élève.Grenoble:PressesuniversitairesdeGrenoble,2010.
· Andant,Christineetal.A proposA1Cahierd'exercices.Grenoble:PressesuniversitairesdeGrenoble,2010.
Références:
· Girardeau,BrunoetNellyMous.RéussirleDELFA1.Paris: Didier,2010.

SUMMER TRAINING

Course Code: BSB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of Summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.5 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.5.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.5 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

- This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BSB 601 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Course Contents:

Module I

Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II

Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III

Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV

Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V

Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code:BSB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Course Contents:

Module I
Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II
Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III
Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, SCP.

Module IV
Production of fermented dairy products

Module V
Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Industrial Microbiology – Cassida

References:
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot &Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **CreditUnits: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code:BSB 620 **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Social Communication Essentials** • Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	**30% Weightage**
2.	**Module II Workplace Interpersonal Skills** • Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	**25% Weightage**
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose** • Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	**10% Weightage**
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:

vii) express their sentiments, emotions and opinions, reacting to information, situations;
viii) narrate incidents, events;
ix) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire uneréservation

Contenu grammatical:

3. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser

2. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BSB 660 **CreditUnits: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.6 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.6.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.6 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

AMITY UNIVERSITY

MADHYAPRADESH

Master of Science (Biotechnology)

Programme Code: MSB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2020 - 22

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.
This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.
The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAM OBJECTIVE

The objective of Masters Programme in Biotechnology of Amity University is to develop multifaceted academically excellent students in various areas of Biotechnology. The course also aims to enhance the knowledge gained by them in the undergraduate curriculum so as to make them competent for future, academic or industrial pursuits.

The subjects included in the course curriculum suffice for both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practicals conducted in well-equipped laboratories. Subjects like Cell Biology, Genetics, Enzymology, Microbiology, Plant Biotechnology, Animal Biotechnology, and Immunology have contents with molecular approach so as to fulfill the requirements of current research and developmental needs. Industry oriented subjects like bioprocess engineering, downstream processing is taught for imparting knowledge of biotechnological application in industry.
In addition, molecular biology and recombinant DNA Technology is taught at advanced levels as they form the core foundation of biotechnology and biotechnological processes.

Therefore the present postgraduate curriculum in Biotechnology is aimed to produce highly motivated challenging young biotechnologist to take our country on the path of Biotechnology revolution.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MSB101	Advanced Biochemistry	3	-	-	3	
MSB102	Advanced Microbial Technology	3	-	-	3	
MSB103	Biophysics & Bioanalytical Techniques	3	-	-	3	
MSB104	Advanced Cell Biology & Genetics	3	1	-	4	
MSB105	Advanced Biostatistics for Biologists	3	-	-	3	
MSB106	Computer Applications	3	-	-	3	
MSB120	Biochemistry Lab	-	-	4	2	
MSB121	Advanced Microbial Technology Lab	-	-	2	1	
MSB122	Cell Biology & Genetics Lab	-	-	2	1	
MSB123	Computer Applications Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB141	Advanced Communication	30	-	-		
MSB143	Self-Development for Interpersonal	30	-	-		
	Foreign Language - I	30	-	-		
MSB144	French					
MSB145	German					
MSB146	Spanish					
MSB147	Japanese					
MSB148	Chinese					

SECOND SEMESTER

Compulsory Courses:						
MSB201	Advanced Molecular Biology	4	-	-	4	
MSB202	Advances in Genetic Engineering	4	-	-	4	
MSB203	Bioprocess Technology	4	-	-	4	
MSB204	Advanced Genomics & Proteomics	4	-	-	4	
MSB205	Computational Biology	3	-	-	3	
MSB206	Environmental Biotechnology	3	-	-	3	
MSB220	Advanced Molecular Biology Lab	-	-	4	2	
MSB221	Genetic Engineering Lab	-	-	4	2	
MSB222	Bioprocess Technology Lab	-	-	4	2	
MSB223	Advanced Genomics & Proteomics Lab			2	1	
MSB224	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MSB241	Communicational for Employment	30	-	-		
MSB243	Conflict Resoultion and Management	30	-	-		
	Foreign Language - II	30	-	-		
MSB244	French					
MSB245	German					
MSB246	Spanish					
MSB247	Japanese					
MSB248	Chinese					

SUMMER INTERNSHIP OF 09 -12 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MSB301	Advanced Immunology	3	-	-	3	
MSB302	Enzyme Technology	3	-	-	3	
MSB303	Drug Design & Development	3	-	-	3	
MSB304	Advanced Animal Biotechnology	3	-	-	3	
MSB305	Advanced Plant Biotechnology	3	-	-	3	
 MSB306 MSB307 MSB308 MSB309 MSB310 MSB311	**Elective (Select any One)** • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
MSB320	Advanced Immunology Lab	-	-	2	1	
MSB321	Enzyme Technology Lab	-	-	2	1	
MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
MSB350	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP341	Advanced Communication - III	30	-	-		
BSP343	Behavioral Science - III	30	-	-		
 FLP344 FLP345 FLP346 FLP347 FLP348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses:						
MSB460	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

ADVANCED BIOCHEMISTRY

Course Code: MSB 101 **Credit Units: 03**

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Course Contents:

Module I

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module II: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module III: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module IV: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module V: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VI: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), Lubert Stryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: **MSB 102** **Credit Units: 03**

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Course Contents:

Module I: Introduction to microbiology

Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms

Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics

Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation. Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology

Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: MSB 103 **Credit Units: 03**

Course Objective:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Course Contents:

Module I: Membrane Biophysics
Genesis of membrane potential in nerve & membrane, Nerst & Goldman equation, Patch Clamp and Voltage – Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**
- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: MSB 104 Credit Units: 04

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and subcellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.

Extrachromosomal inheritance:, Mitocondrial and chloroplast genetic code

Chromosomal aberration and polyploidy

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage.

Population genetics- Hardy weinbergs selection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase, Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer**,** cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MSB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: MSB 106 Credit Units: 03

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers

Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office

Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.

Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system

Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce

Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language

Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF .. ELSE statements – Looping concepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj & Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: **MSB 120** **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test.
Quantitation of protein by Bradford method
Separation of proteins by SDS-PAGE

Module II: Enzyme
Enzyme activity study of serum alkaline phosphatase

Module III: Nucleic Acid
Biochemical estimation of DNA
Biochemical estimation of RNA
Separation of DNA on Agrose gel.

Module IV: Carbohydrate
Biochemical estimation of blood sugar

Module V: Lipids
Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ADVANCED MICROBIAL TECHNOLOGY LAB

Course Code: **MSB 121** **Credit Units: 01**

Course Contents:

Module I
Aseptic techniques: preparation of culture media for cultivation of specific microorganism.
Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II
Biochemical test - Indole test. methyl red test. voges proskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III
Isolation of special microbes from environment by isolation and enrichment techniques
Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD
Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV
Antibiotic sensitivity test by disc diffusion assay

Module V
Biochemical and molecular characterization of micro organisms
Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: MSB 122 Credit Units: 01

Course Contents:

Module I
Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II
Isolation of chloroplast from spinach and study of electron transport chain.

Module III
Isolation of mitochondria and study of electron transport chain.

Module IV
Study of apoptosis by TUNEL method.
Site directed mutagenesis
Mutation detection and analysis
Mitosis
Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: MSB 123 Credit Units: 01

Course Contents:

Module I: Ms-Office
Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003
Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language
Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

ADVANCED COMMUNICATION

Course Code: **MSB 141** **Credit Units: 01**

Course Objective:
The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: **MSB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MSB 144** **Credit Units: 02**

Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1, 2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

7. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
8. dire/interroger si on comprend
9. Nommer les choses

Unité 2: Faire connaissance

5. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
6. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

15. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
16. article indéfini, défini, contracté
17. nom, adjectif, masculin, féminin, singulier et pluriel
18. négation avec « de », "moi aussi", "moi non plus"
19. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
20. pronom tonique/disjoint- pour insister après une préposition
21. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED MOLECULAR BIOLOGY

Course Code: MSB 201 Credit Units: 04

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Course Contents:

Module I: DNA replication and repair

DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA

Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA

Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation

Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.

Module V: Regulation of gene expression

Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing

RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme
Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: **MSB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes. Baculo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: **MSB 203** **Credit Units: 04**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**
- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: **MSB 204** **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

PART I: GENOMICS

Module I
Introduction to Genomics: The human genome project “Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II
Transcriptomics and metatranscriptomics: Introduction , method and uses. genetic mapping

Module III
Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV
Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V
Introduction to proteomics
Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI
Post translational protein modification

Module VII
Protein – protein interaction some examples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: **MSB 205** **Credit Units: 03**

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

15. Major information Resources & Databases in Bioinformatics
    a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
    b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
    c. Derived (Secondry) Databases of Sequences and structure:
        i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
        ii. SCOP, CATH, DSSP, FSSP, RNAbase,
    d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
16. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
17. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
18. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
19. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
20. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
21. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)
Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.
Suffix tree and its applications in Bioinformatics
Gene Indentification Methods
Predictive Methods using DNA and Protein sequences.
Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.
Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.
Phylogenetics analysis software.
Molecular Structure drawing tool.
Molecular modeling/Docking.
Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

***References*:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MSB 206** **Credit Units: 03**

Course Objective:

The objective of this course is to familiarize the students with the processes and micro organism that can be employed for a cleaner environment. The students will be applying basic knowledge of microbiology for developing the practices for a cleaner environment, water, fuel, fertilizer, pesticides etc. The course also aims to make the students aware of legislation and acts prevalent to control the degradation of our eco system.

Course Contents:

Module I

Treatment of municipal wastes and industrial effluents (Physico-Chemical, biological analysis of waste water), Rr. Sec and test waste water treatment sludge treatment and disposal treatment of wastes from paper, textile, dairy, petrochemical and pharmaceutical industry .

Module II

Bioremediation and phytoremediation of toxic compounds like pesticides, hydrocarbons, polymers, surfactants, biotransformation and bioaccumulation

Module III

Renewable and non-renewable energy resources, clean fuel technology, biofuels.

Module IV

Biofertilizers and biopesticides – a cleaner agricultural practice, concept of N_2 - fixation, azolla, cyanobacteria, Rhizobium and VAM as biofertilizers.

Module V

Biomining – microbe assisted microbial leaching, bioaccumulation and bio sorption
Biosensors and biomarkers for ecotoxicity measurement, EIA and Environmental audit.

Module VI

Principles in ecotoxicology; animal toxicity tests; statistical concepts of LD_{50}; dose-effect and dose response relationship; frequency response and cumulative response; Biological and chemical factors and influence toxicity; global dispersion of toxic substance; dispersion and circulating mechanisms of pollutants; Aquatic toxicity testes; statistical tests; response of planktons to toxicants; EC_{50};

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Introduction to Environmental Biotechnology, Milton Wainwright

References:
- Waste Water Engineering, Metcalf and Eddy. Publisher: Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, Jonh F.T. Spencer
- Principles of Environmental Engineering, Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: **MSB 220** **Credit Units: 02**

Course Contents:

17. Isolation of genomic DNA from prokaryotic and Eukaryotes.
18. Isolation of plasmid.
19. Study of DNA protein interaction.
20. Study of in vitro transcription.
21. Study of DNA methylation.
22. Study of DNA repair mechanism.
23. Invitro study of translation
24. Isolation of RNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: **MSB 221** **Credit Units: 02**

Course Contents:

15. Study of gene expression in E.coli.(GFP cloning).
16. Study of Southern Hybridization.
17. Study of RFLP/RAPD.
18. Study of Western blotting.
19. Study of restriction digestion.
20. Study of legation.
21. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: **MSB 222** **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: **MSB 223** **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II

PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF data using PDquest software

Module IV

Primer designing, Analysis of protein 3D structures and comparison,. Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: **MSB 224** **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MSB 241** **Credit Units: 01**

Course Objective:

To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: MSB 243 Credit Units: 01

Course Objective:

This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MSB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

7. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
8. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
9. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

Unité 4: Découvrir son environnement

9. situer un lieu
10. s'orienter, s'informer sur un itinéraire.
11. Chercher, décrire un logement
12. connaître les rythmes de la vie

Unité 5: s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

ADVANCED IMMUNOLOGY

Course Code: **MSB 301** **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.

Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: **MSB 302** **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes
Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

DRUG DESIGN AND DEVELOPMENT

Course Code: **MSB 303** **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

***References*:**

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: **MSB 304** **Credit Units: 03**

Course Objective:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Course Contents:

Module I

Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II

Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III

DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV

Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V

Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: MSB 305 **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques
Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II
Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III
Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV
Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V
Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DELIVERY SYSTEMS

Course Code: **MSB 306** **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MSB 307** **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs.

Module IV
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14 Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MSB 308** **Credit Units: 03**

Course Objective:

The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:
- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: **MSB 309** **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases.
Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy**.**

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections.
Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: **MSB 310** **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code : MSB 311 **Credit: 03**

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

11. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
12. Organizational Structure and management
13. Capital Management
14. Product innovation and management
15. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

7. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
8. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
9. Basics of material management

Module III

9. Kaizen { Continuous improvement in product and management }
10. Six Sigma
11. Biotech enterprises: Small, Medium and Large.
12. Quality control in Biotech industries.

Module IV

9. Government Regulations for Biotech product.
10. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
11. Business development for medical products.
12. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne & Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

.ADVANCED IMMUNOLOGY LAB

Course Code: MSB 320 **Credit Units: 01**

Course Contents:

15. Purification of immunoglobin G.
16. Study of antigen- antibody pattern (ODD).
17. Study of sandwich ELISA.
18. Study of haemeagglutination.
19. Study of immunoelectrophoresis.
20. Isolation and identification of rosette cells.
21. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ENZYME TECHNOLOGY LAB

Course Code: MSB 321 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: **MSB 322** **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

13. Histological study of important animal tissues.
14. Estimation of enzyme activity from animal tissues.
15. Study of toxicity on invitro model.
16. Culture and maintenance of animal cell lines.
17. Culture of chicken fibroblasts.
18. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

13. Tissue culture lab and organization. Sterilisation of glasswares, tools and equipments.
14. Preparation of stocks and media. Surface sterilization of various explants
15. ORGAN CULTURE
16. Cllus culture
17. Anther culture
18. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED COMMUNICATION –III

Course Code: BCP 341 **Credit Units: 01**

Course Objective:

The course is designed to develop competence in communication skills related to production & presentation of messages in multiple formats & understand the importance of body language.
Prerequisites: NIL

Module I Written Communication	**40% Weightage**
• Coherence and Structure • Précis Writing • Writing Paragraphs & Essays	
Module II Developing Writing Skills	**30% Weightage**
• Business Letter/Official Correspondence • Social Correspondence • Emails & Netiquette	
Module III Business Presentations	**30% Weightage**
• Planning, Design and Layout of Presentation • Contents : Information Packaging & Delivery • Personal Branding	
Student Learning Outcomes	
The student will be able to write impressive official correspondence and also learn to make and give effective presentations in a professional environment.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:
Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994
Lesikar & Flatley, Basic Business Communication, Tata McGraw- Hill Edition

Reference:
Guffey, Ellen Mary, Business Communication, Thomson (South Western)
Business Communication for Managers, Payal Mehra Pearson 2012
Additional Reading: Newspapers and Journal.

BEHAVIOURAL SCIENCE – III

Course Code: BSP-343 **Course Credit: 01**

Course Objective:

This course will help the students to:

- Importance of Personal and Professional excellence
- Inculcating the components of excellence
- Explore interest, attitude and Explore career opportunities
- Set career goals

Course Contents:

Module I: Professional Competence **(2 Hours)**

- Understanding Professional Competence
- Component of Competence:

    Knowledge
    Skills
    Attitude
    Self awareness
    Self Promotion & Presentation,
    Self confidence
    Skills
    Performance

- Political awareness, Coping with uncertainty
- Developing positive attributes at work place (personal and professional)
- Time management
- Handling criticism and interruptions
- Managing difficult people
-

Module II: Managing Personal Effectiveness **(2 Hours)**

- Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness)
- Integration of personal and organizational vision for effectiveness
- A healthy balance of work and play

Module III: Components of Excellence **(2 Hours)**

- Positive Imagination & Focused
- SMART Goal
- Controlling Distraction
- Commitment
- Constructive Evaluation
- Creativity & Success

Module IV: Career Development **(2 Hours)**

- Understanding Development Process
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude
- Selecting from available resources
- Career planning and development

Module V: Personal & Professional Success **(2 Hours)**

- Career Selection & Motivation.
- Action planning Networking Negotiation.
- Accept Change & Challenge for Successful career.

Student learning outcomes:

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers
- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan, D. (2005). Information and Knowledge Management, Macmillan India Ltd. Delhi

Français-III

CourseCode:FLP 344 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictools
- totalkaboutwork andproblemsrelatedtowork
- toperform simple communicative tasks(explaininga setback,askingforapostponementofappointment,give instructions,place orders,reserve, holda telephone conversation,write e-mails,replytomessages)
- toprepare arésumé andtoappearforinterviews

CourseContents:

Unité 5, 6:pp. 74to104

Actesde communication:

Unité 5:Travail

11. mangeraurestaurant,comprendreunmenu,commander
12. engagerune conversationtéléphonique
13. présentersonrésumé: parlerde sa formation,de sonexpérience,de ses compétences
14. raconterdesévénementspassés
15. consultersa boîte e-mails,répondreauxmessages

Unité 6:Problèmes

11. identifierunproblème,demanderdesprécisions
12. expliqueruncontretemps,déplacerunrendez-vous
13. demanderde l'aide (partéléphone,pare-mail)
14. donnerdesinstructions
15. expliquerunproblème,suggérerunesolution.

Grammaire :

21. futur proche, articles partitifs, un peu de, beaucoup de, une bouteille de, Un morceau de.
22. pronoms COD, venir de + infinitif, verbes appeler (au présent)
23. passé composé avec avoir, affirmatif et interrogatif, savoir et connaître
24. passé composé avec être, accord du participe passé, négation
25. pronoms COI, être en train de
26. ne…rien, ne…personne, ne…plus, ne…pas encore, qu'est-ce que/ qu'est-ce qui/qui est-ce que/qui est-ce qui.
27. passé composé des verbes pronominaux.
28. si/quand+présent, ne…plus, ne …pas encore.
29. impératif présent (2) place du pronom et verbes pronominaux.
30. Trop /pas assez, verbe devoir au conditionnel présent.

Examination Scheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage (%)	15	10	5	**30**	**70**	**100**

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

SUMMER INTERNSHIP

Course Code: MSB 350 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

7. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

7.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

7.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate’s name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

7.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

7.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

7.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

7.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

7.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

7.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

7.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

7.10 List of Acronyms and Standards

7.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

7.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

7.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

8. Production of Project Report

8.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

8.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

8.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

8.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

8.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

9. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

9.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

9.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

9.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

9.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

9.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

9.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

9.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- ## Title or Cover Page

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- ## Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- ## Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- ## Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- ## Review of Literature and Definition of Problem

- ## Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: MSB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

The report should be hard bound and for color coding scheme refer NTCC guidelines.

It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(xi) Long Tables
(xii) Long quotations
(xiii) Foot notes
(xiv) Multilane captions
(xv) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor’s Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar’s signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?
Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[11] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[12] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[13] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[14] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[15] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[13] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[14] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[15] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY
MADHYA PRADESH

Master of Technology (Biotechnology)

Programme Code: MTB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2020 – 22

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2018

PROGRAMME OBJECTIVE

Biotechnology is the technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.The main objective of this programme is to provide a balanced and comprehensive knowledge of the basic as well as applied sciences related to Biotechnology that would enhance the basic aptitude of each student and prepare them to take up the challenges in the varied and multi-faceted applications of Biotechnology. It will empower the students with the latest tools, techniques and awareness in biotechnology and will facilitate comprehensive learning combining the scientific and technological aspects

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB101	Biochemistry & Metabolic Regulation	4	-	-	4	
MTB102	Advanced Microbial Technology	4	-	-	4	
MTB103	Instrumentation in Biotechnology	4	-	-	4	
MTB104	Bioinformatics	4	-	-	4	
MTB105	Advance Biostatistics for Biologists	3	-	-	3	
MTB120	Biochemistry Lab	-	-	4	2	
MTB121	Microbiology Lab	-	-	2	1	
MTB122	Instrumentation in Biotechnology Lab	-	-	2	1	
MTB123	Bioinformatics Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB141	Advanced Communication	30	-	-		
MTB143	Self-Development for Interpersonal Skills	30	-	-		
 MTB144 MTB145 MTB146 MTB147 MTB148	Foreign Language - I French German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB201	Cell & Molecular Biology	4	-	-	4	
MTB202	Recombinant DNA Technology	4	-	-	4	
MTB203	Bioprocess Technology	4	-	-	4	
MTB204	Genomics & Proteomics	4	-	-	4	
MTB205	Pharmaceutical Biotechnology	3	-	-	3	
 MTB206 MTB207 MTB208 MTB209 MTB210 MTB211	**Elective-I (any one)** • Environmental Biotechnology • Biosensors • Artificial Neural Networks • Agriculture Biotechnology • Fundamentals of Computers & Programming in "C" • Bio-energy Engineering	3	-	-	3	
MTB220	Cell & Molecular Biology Lab	-	-	4	2	
MTB221	Recombinant DNA Technology Lab	-	-	4	2	
MTB222	Bioprocess Technology Lab	-	-	4	2	
MTB223	Genomics & Proteomics Lab	-	-	2	1	
	TOTAL				**29**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
MTB241	Communicational for Employment	30	-	-		
MTB243	Conflict Resoultion and Management	30	-	-		
 MTB244 MTB245 MTB246 MTB247 MTB248	Foreign Language - II French German Spanish Japanese Chinese	30	-	-		

SUMMER PROJECT: 8 - 10 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MTB301	Immunology & Immunotechnology	4	-	-	4	
MTB302	Enzymology & Enzyme Technology	4	-	-	4	
MTB303	Drug Design & Development	4	-	-	4	
MTB304	Bioprocess Plant Design	3	-	-	3	
	Elective - II (any one)	3	-	-	3	
MTB305	• Pollution Prevention Fundamentals					
MTB306	• Drug Delivery Systems					
MTB307	• IPR, Biosafety & Bioethics					
MTB308	• Advanced Food Technology					
MTB309	• Industrial Safety & Management					
MTB310	• Advanced Animal & Plant Cell Technology					
MTB320	Immunology & Immunotechnology Lab	-	-	4	2	
MTB321	Enzymology & Enzyme Technology Lab	-	-	2	1	
MTB360	Summer Project (Evaluation)	-	-	-	12	
	TOTAL				**33**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP341	Advanced Communication - III	30	-	-		
BSP343	Behavioural Science - III	30	-	-		
	Foreign Language - III	30	-	-		
FLP344	French - III					
FLP345	German					
FLP346	Spanish					
FLP347	Japanese					
FLP348	Chinese					

FOURTH SEMESTER

Compulsory Courses:						
MTB460	Project (20-22 weeks)	-	-	-	30	
	TOTAL				**30**	

Curriculum & Scheme of Examination

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: **MTB 101** **Credit Units: 04**

Course Objective:

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

Course Contents:

Module I
Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II
Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III: Modes of Regulation
Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways
Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation, Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Biochemistry by A. Lehninger revised by Nelson and Cox.
- Biochemistry by Mathews, Van Holde and Ahern. IIIrd Edition.

References:

- “Biochemistry” by White, Handler and R.B. Smith 7th Ed. 1983
- Biochemistry” by L.Stryer Third Edition.
- Biochemistry by Voet and Voet.
- Fundamentals of Biochemistry by Conn and Stumph.

ADVANCED MICROBIAL TECHNOLOGY

Course Code: **MTB 102** **Credit Units: 04**

Course Objective:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

Course Contents:

Module I

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

Module II

Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module III

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

Module IV

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

Module V

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill.
- Microbiology by Prescott.

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Macmillian
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

INSTRUCTION IN BIOTECHNOLOGY

Course Code: MTB 103 Credit Units: 04

Course Objective:
To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Course Contents:

Module I: Ultracentrifugation
Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

Module II: Gel electrophoresis
Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

Module III
TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

Module IV
UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.

Module V
Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Module VI
Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:
- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John Wiley and Sons Ltd.
- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

BIOINFORMATICS

Course Code: MTB 104 **Credit Units: 04**

Course Objective:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Course Contents:

Module I: Introduction and overview

The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.

Module II

Exact string matching -classical comparison based methods, semi numerical string matching, suffix trees - construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison

Module III

Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.

Module IV

Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees , estimating the rate of change, likelihood and trees; analysis software.

Module V

Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases–PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformaticsby C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: **MTB 105** **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Course Contents:

Module I: Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

BIOCHEMISTRY LAB

Course Code: **MTB 120** **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity

Module II: Nucleic Acid
Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel.
Carbohydrate: Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar
Lipids: Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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MICROBIOLOGY LAB

Course Code: **MTB 121** **Credit Units: 01**

Course Contents:

Module I
Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

Module II
Biochemical test – Indole test, methyl red test, voges proskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: **MTB 122** **Credit Units: 01**

Course Objective:
To demonstrate the techniques used in the biotechnology for purification, characterization and identification of the proteins and other biotechnologically important products

Course Contents:
Module I: Cell disruption techniques
homogenization, sonication
Module II
Centrifugation – low speed and high speed.
Module III: Spectrophotometer techniques
Visible and UV spectrophotometry
Module IV
Chromatography-ion exchange, gel filtration and affinity columns, fraction collection, monitoring UV absorbance. Applications in enzyme purification.
Module V
Techniques for removal of salt/solvent from a sample -desalting, dialysis, ultrafiltration, speedvac, lyophilization etc.
Module VI
Electrophoresis –1 D (Polyacryamide gel electrophoresis and agarose) and 2D. Isoelectric focusing.
Module VII
Polarization and fluorescence microscopy

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOINFORMATICS LAB

Course Code: **MTB 123** **Credit Units: 01**

Course Objective:
To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

Course Contents:
Module I
Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
Module II
Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment
Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
Module III
Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing
Module IV
Phylogenetic prediction and analysis
Module V
Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.
Module VI
Finding transcription regulatory signals

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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ADVANCED COMMUNICATION

Course Code: **MTB 141** **Credit Units: 01**

Course Objective:

The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

Course Contents:

Module I: Listening Skills
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

Module II: Speaking Skills
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

Module III: Reading Skills
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

Module IV: Writing Skills
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

Module V: Activities
News reading
Picture reading
Movie magic
Announcements

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

SELF-DEVELOPMENT AND INTERPERSONAL SKILLS

Course Code: **MTB 143** **Credit Units: 01**

Course Objective:

This course aims at imparting an understanding of:
Self and the process of self exploration
Learning strategies for development of a healthy self esteem
Importance of attitudes and their effect on work behaviour
Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self
Formation of self concept
Dimension of Self
Components of self
Self Competency

Module II: Self-Esteem: Sense of Worth
Meaning and Nature of Self Esteem
Characteristics of High and Low Self Esteem
Importance & need of Self Esteem
Self Esteem at work
Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power
Introduction to EI
Difference between IQ, EQ and SQ
Relevance of EI at workplace
Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence
Need and importance of Emotions
Healthy and Unhealthy expression of emotions
Anger: Conceptualization and Cycle
Developing emotional and interpersonal competence
Self assessment, analysis and action plan

Module V: Leading Through Positive Attitude
Understanding Attitudes
Formation of Attitudes
Types of Attitudes
Effects of Attitude on
Behaviour
Perception
Motivation
Stress
Adjustment
Time Management
Effective Performance
Building Positive Attitude

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

FRENCH - I

Course Code: **MTB 144** **Credit Units: 02**

Course Objective:
To familiarize the students with the French language
- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

Course Contents:

Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2
Only grammar of Unité 3: objectif 3, 4 and 5

Contenu lexical: Unité 1 : Découvrir la langue française : (oral et écrit)

10. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
11. dire/interroger si on comprend
12. Nommer les choses

Unité 2: Faire connaissance

7. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
8. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

Unité 3: Organiser son temps

22. dire la date et l'heure

Contenu grammatical:

1. organisation générale de la grammaire
23. article indéfini, défini, contracté
24. nom, adjectif, masculin, féminin, singulier et pluriel
25. négation avec « de », "moi aussi", "moi non plus"
26. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
    Interro-négatif : réponses : oui, si, non
27. pronom tonique/disjoint- pour insister après une préposition
28. futur proche

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

CELL AND MOLECULAR BIOLOGY

Course Code: MTB 201 Credit Units: 04

Course Objective:

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

Course Contents:

Module I

Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.

Module II

Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.

Module III

Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.

Module IV: Replication

Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease.

Recombination & Repair: Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.

Module V

Transcription - RNA transcription and the proteins required for each step, maturation of the RNA transcript derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression

Module VI: Translation

Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Molecular Cell Biology by Bruce Albert
- Molecular Biology by Lodish Darnell and Baltimore
- Molecular Biology of the gene by Watson et al 4th ed.

References:

- Genes VIII by Benjamin Lewis
- Genetics by Ursula Goodenough
- Cytogenetics by l Garl P. Swanson, Mertz & Young
- Biochemistry by Stryer
- Genome by T.A. Brown, John Willey and Sons Inc.

RECOMBINANT DNA TECHNOLOGY

Course Code: **MTB 202** **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Course Contents:

Module I

Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

Module II: Gene isolation

Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

Module III: Heterologous gene expression (bacteria and yeast)

Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

Module IV: Studying gene regulation and control

In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

Module V: Automation and robotic advances in RDT

DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation

Module VI: Laboratory, industrial and environmental applications of RDT

High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- "Gene Expression Technology" by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- "DNA Cloning: A Practical Approach" by D.M. Glover and B.D. Hames, IRL Press.

BIOPROCESS TECHNOLOGY

Course Code: **MTB 203** **Credit Units: 04**

Course Objective:

The present course aims to aware about the requirements for large-scale cultivation of microbes for production of industrially important products with purification and characterization of these bioproducts using different techniques

Course Contents:

Module I

Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch.

Module II

Substrates for bioconversion processes and design of media, sterilization; Cell culture techniques; Inoculum development and aseptic transfers. Bioreactors – CSTR, CSTR in series , tower, loops, airlift bubble column & packed bed. Different types of pumps, valves, and line materials, piping convections etc. used in Biochemical Processes

Module III

Process technology for the production of primary metabolites, e.g. Baker's yeast, ethanol, citric acid, amino acids (lysine and glutamic acid). Microbial production of industrial enzymes (glucose isomerase, cellulase, amylase, lipase, protease) and secondary metabolites (penicillins, cephalosporins and streptomycin). Biomass (SCP and mushroom) production from agro-residues.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition , uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery , uses of various forms etc.

Streptomycin – chemical structure, production, harvest and recovery, use, by-product of streptomycin fermentation etc.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Glutamic Acid: Direct Fermentation, contribution of feed back control and regulation of cell permeability barrier for production.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Module IV

Characteristics of bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press.
- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
- Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, W.F. Veith, John Wiley and Sons Inc.
- Biochemical Engineering, S. Aiba, A.E. Humphrey and N.F. Millis, University of Tokyo Press.
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Process Engineering in Biotechnology, A.T. Jackson, Prentice Hall.
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering/ Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society.

GENOMICS AND PROTEOMICS

Course Code: **MTB 204** **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Course Contents:

GENOMICS

Module I: Introduction to Genomics
Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes
Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods.

Module III
Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module IV
Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.

Module V
Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.

Module VI
Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA : Structure and Function, Richard R. Sinden
- www.panimaText.com

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: **MTB 205** **Credit Units: 03**

Course Objective:

The main objectives are to cover representative pharmaceutical dosage forms, and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

Course Contents:

Module I
Introduction to Physical Pharmaceutics - Metrology and Calculations,

Module II
Molecular structure, properties and States of Matter, Solutions, Phase Equilibra, Micromeritic and Powder Rheology, Surface and Interfacial Phenomena, Dispersion Systems, Diffusion & Dissolution, Kinetics and drug stability, Viscosity & Rheology

Module III
Polymer Science and Applications, Formulations and Development, Packaging

Module IV
Introduction to Industrial Processing, Transport Phenomena (Fluid Flow, Heat Transfer and Mass Transfer)

Module V
Particulate Technology (Particle Size, Size reduction, Size Separation, Powder Flow and Compaction), Unit Operations (Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, and Drying)

Module VI
Materials of Pharmaceutical Plant Construction, Good Manufacturing Practice (GMP's) Guidelines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Bentley's Pharmaceutics by E A Rawlins
- Pharmaceutical Sciences by Remington

References:
- Physical Pharmacy by Alfred Martin.
- Cooper and Gunn's Tutorial Pharmacy

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: **MTB 206** **Credit Units: 03**

Course Objective:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I
Environmental components, Natural resources, Ecosystem and its diversity, Environmental pollution and its major impacts, Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Land degradation, Biomagnification

Module II
Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III
Biodegradation and bioremediation of major pollutants, Biomineralisation: Use of microbial technology for mining

Module IV
Waste water engineering: Treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V
Bioassessment of environmental quality: Biosensors and biomarkers, Biofertilizers, Biopesticides and Vermi composting

Module VI
Environmental impact assessment and Environmental audit, Related case studies from Indian market

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:
- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

BIOSENSORS

Course Code: MTB 207 Credit Units: 03

Course Objective:

On completion of the module students should Be able to Appreciate the basic configuration and distinction among biosensor systems, To gain an understanding of general biosensor principles and terms, To be able to design, model, simulate, fabricate, and test a biosensor, To gain an overall knowledge of biosensor types, applications, requirements, and capabilities to allow improved interaction with physicians, clinicians, and biomedical engineers, and to enable the student to conduct biomedical engineering research.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and transducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Affinity Biosensors: Techniques and Protocol by K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applications by V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors by B.R. Eggins, John Wiley and Sons Inc.

References:

- Sensors and Sensing in Biology and Engineering by F.G. Barth, wt al, Springer Verlag.
- Biosensors by Minh Canh. Tran
- Biosensors: Theory and Applications by Donald G. Buerk
- Enzyme and Microbial Biosensors: : Techniques and Protocols - by Kim R. Rogers, Ashok Mulchandani
- Biosensors in Environmental Monitoring - by Ursula Bilitewski, Anthony P. F. Turner.
- Biosensors: Micro electrochemical Devices - by Marc J. C. Lambrechts
- Biosensors with Fiberoptics - by Donald Lee Wise, Lemuel B. Wingard
- Biosensors and Their Applications - by That Tjien Ngo, Victor Chi-Min Yang
- Thermal Biosensors, Bioactivity, Bioaffinity -by Prakash K. Bhatia
- Novel Approaches in Biosensors and Rapid Diagnostic Assays - by Zvi Liron, Avraham Bromberg, Morly Fisher
- Biosensors - by Anthony E. G. Cass.

ARTIFICIAL NEURAL NETWORKS

Course Code: **MTB 208** **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, besides the closely related aspects of artificial neural networks.

Course Contents:

Module I
Historical background, Why is learning hard?

Module II
Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multilayer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning.

Module III
The back propagation algorithm, Aspects of Learning Theory and Generalization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?.

Module IV
Neural networks and analog VLSI, Selected Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Neural Networks: A Comprehensive Foundation by S. Haykin, Prentice Hall.

References:

- Neutral Networks for Pattern Recognition by C. Bishop, Oxford University Press.

AGRICULTURE BIOTECHNOLOGY

Course Code: **MTB 209** **Credit Units: 03**

Course Objective:

This course is designed to cover key concepts in the structure and manipulation of DNA and inheritance of genes, traditional plant breeding, current impact of biotechnology on crop production and its commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation.

Course Contents:

Module I
Sterilization; Nutrient medium; Callus & Suspension culture; canning, regulation; Micropropagation, production of virus free plants, anther culture, pollen culture; ovary culture, homozygous lines; meristem culture; somatic hybridization, somaclonal variation, germplasm conservation

Module II
Genetic engineering in plants, direct and indirect method of plant cell transformation, vectors with special reference to Ti plasmids, selectable markers, mechanism of T-DNA transfer to plants, transgenic plants, molecular maps and gene tagging, marker assisted selection

Module III
Applications of genetic engineering, insect and pest resistance, herbicide resistance, cytoplasmic male sterility in plants, molecular farming.

Module IV
Plant patents, plant variety certificates, safety regulation in transgenic plants.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

FUNDAMENTALS OF COMPUTERS AND PROGRAMMING IN ‘C’

Course Code: **MTB 210** **Credit Units: 03**

Course Objective:

The main objectives of the course are to demonstrate familiarity with computer, show understanding of computer hardware and software, display basic understanding of computer programming processes, develop understanding of computer file management and protection principles, explain Internet, LAN and digital media fundamentals, define information systems analysis and design concepts, identify and demonstrate use of database concepts.

Course Contents:

Module I
Introduction to Digital Computer: Major components of a Digital Computer - Number system - Binary codes - Fixed and Floating Point representation - Logic gates - Flip flops - Registers - Input and Output Devices.

Module II: Introduction to programming
Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program.

Module III: Data Types
Variables - Constants - Arithmetic expressions - Use of operators - program examples.

Module IV: Decision making in C
Relational operators - Logical operators - Precedence of operators - IF and IF ... ELSE statements – Looping concepts in C _ WHILE loop - DO ... WHILE and FOR loops - Programming examples.
Functions: User defined Functions - Local and Global variables - Parameters - Programming examples.

Module V: Arrays
BREAK statement - Strings and character arrays - examples.
Pointers: Concept of Pointers - The Indirection operator - Use of Pointers in arrays - Programming examples.

Module VI: Structures
The period operator - Arrays of structures - Arrays within structures - Structures within structures - Pointers to structures - The arrow operator - Programming examples.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamentals of Computers by V. Rajaraman
- C Programming" by G. Kochan

References:
- Computer Fundamentals by B. Ram.
- The Spirit of C" by Mullish Cooper.

BIO-ENERGY ENGINEERING

Course Code: **MTB 211** **Credit Units: 03**

Course Objective:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling.

Course Contents:

Module I: Biomass Sources, Characteristics & Preparation
Biomass Sources and Classification. – Chemical composition and properties of different biomass materials and bio-fuels – Sugar cane molasses and other sources for fermentation ethanol-Sources and processing of oils and fats for liquid fuels- Energy plantations
-Preparation of woody biomass: Size reduction, Briquetting of loose biomass, Drying, Storage and Handling of Biomass.

Module II: Biogas, Technology
Feedstock for biogas production, Aqueous wastes containing biodegradable organic matter, animal residues-. Microbial and biochemical aspects- Operating parameters for biogas production Kinetics and mechanism - Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.

Module III: Bio-Ethanol and Bio-Diesel Technology
Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

Module IV: Pyrolysis and Gasification of Biomass
Thermo-chemical conversion of ligno-cellulose biomass – Biomass processing for liquid fuel production - Pyrolysis of biomass-Pyrolysis regime, effect of particle size, temperature, and products obtained.
Thermo-chemical gasification principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidized Bed Gasifiers.

Module V: Combustion of Biomass and Cogeneration Systems
Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Fuels from Biomass and Wastes by D.L. Klass and G.M. Emert, Ann Arbor Science pub. Inc. Michigan,
- Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes by A. Chakraverthy, Oxford & IBH publishing Co., New Delhi,

References:

- Biogas Systems: Principles and Applications by K.M. Mital, New Age International Publishers (p) Ltd.,
- Biomass Energy Systems, by P. Venkata Ramana and S.N. Srinivas, Tata Energy Research Institute, New Delhi, 1996.
- Bio-gas Technology by Khandelwal K.C. and Mahdi, Tata McGraw-Hill pub. Co. Ltd., New Delhi
- Advances in bio-gas Technology by O.P. Chawla, I.C.A.R., New Delhi. 1970.

CELL AND MOLECULAR BIOLOGY LAB

Course Code: **MTB 220** **Credit Units: 02**

Course Objective:
The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:
22. Isolation of genomic DNA from prokaryotic and Eukaryotes
23. Isolation of plasmid.
24. Study of apoptosis by TUNEL method
25. Isolation of cell organelles by ultracentrifugation.
26. Study of in vitro transcription.
27. Study of DNA repair mechanism
28. Site-directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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RECOMBINANT DNA TECHNOLOGY LAB

Course Code: **MTB 221** **Credit Units: 02**

Course Contents:

22. Preparation and Transformation of competent cells by CaCl2 method.

23. Restriction digestion

24. Legation

25. Southern hybridization

26. Western blotting

27. RFLP

28. PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOPROCESS TECHNOLOGY LAB

Course Code: **MTB 222** **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

GENOMICS AND PROTEOMICS LAB

Course Code: **MTB 223** **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Analysis of 2D – IEF data

Module IV

Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMMUNICATIONAL FOR EMPLOYMENT

Course Code: **MTB 241** **Credit Units: 01**

Course Objective:

To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

Course Contents:

Module I: Fundamentals of Communication
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

Module II: Verbal Communication (Written)
Business Letter
Social correspondence
Writing resume and Job applications

Module III: Speaking skills
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

Examination Scheme:

Components	**CT1**	**CT2**	**CAF**	**V**	**GD**	**GP**	**A**
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

BEHAVIOURAL COMMUNICATION AND RELATIONSHIP MANAGEMENT

Course Code: **MTB 243** **Credit Units: 01**

Course Objective:
This course aims at imparting an understanding of:
Process of Behavioural communication
Aspects of interpersonal communication and relationship
Management of individual differences as important dimension of IPR

Course Contents:

Module I: Behavioural Communication
Scope of Behavioural Communication
Process – Personal, Impersonal and Interpersonal Communication
Guidelines for developing Human Communication skills
Relevance of Behavioural Communication in relationship management

Module II: Managing Individual Differences in Relationships
Principles
Types of issues
Approaches
Understanding and importance of self disclosure
Guidelines for effective communication during conflicts

Module III: Communication Climate: Foundation of Interpersonal Relationships
Elements of satisfying relationships
Conforming and Disconfirming Communication
Culturally Relevant Communication
Guideline for Creating and Sustaining Healthy Climate

Module IV: Interpersonal Communication
Imperatives for Interpersonal Communication
Models – Linear, Interaction and Transaction
Patterns – Complementary, Symmetrical and Parallel
Types – Self and Other Oriented
Steps to improve Interpersonal Communication

Module V: Interpersonal Relationship Development
Relationship circle – Peer/ Colleague, Superior and Subordinate
Initiating and establishing IPR
Escalating, maintaining and terminating IPR
Direct and indirect strategies of terminating relationship
Model of ending relationship

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

FRENCH - II

Course Code: **MTB 244** **Credit Units: 02**

Course Objective:

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

Course Contents:

Module A: pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6

Module B: pp. 47 to 75 Unité 4, 5

Contenu lexical: **Unité 3: Organiser son temps**

10. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
11. rédiger un message/ une lettre pour …
    i) prendre un rendez-vous/ accepter et confirmer/ annuler
    ii) inviter/accepter/refuser
12. Faire un programme d'activités
    imaginer une conversation téléphonique/un dialogue
    Propositions- interroger, répondre

Unité 4: Découvrir son environnement

13. situer un lieu
14. s'orienter, s'informer sur un itinéraire.
15. Chercher, décrire un logement
16. connaître les rythmes de la vie

Unité 5: s'informer

13. demander/donner des informations sur un emploi du temps passé.
14. donner une explication, exprimer le doute ou la certitude.
15. découvrir les relations entre les mots
16. savoir s'informer

Contenu grammatical:

1. Adjectifs démonstratifs
17. Adjectifs possessifs/exprimer la possession à l'aide de :
    i. « de » ii. A+nom/pronom disjoint
18. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
19. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
20. passé composé
21. Questions directes/indirectes

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: **MTB 301** **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents:

Module I

Phylogeny of Immune System, Types of immunity clonal nature of immune response. Organization and structure of lymphoid organs. Antibody structure and function. Major histocompatibilty: Complex BCR and TCR, generation of antibody diversity, Complement system

Module II: Cells of the immune system

Hematopoiesis and differentiation, antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance.

Module III

Cell mediated toxicity, Hypersensitivity, Autoimmunity, Vaccines: General considerations, ideotype network hypothesis

Module IV

Tumor immunology, Transplantation immunology, Immunotheropy.

Module V

Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, (FACS) Hybridoma technology and its application

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Immunology by J. Kubey Fence Creek Publishing (Blackwell).
- Immunology by Ivan Riott

References:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: **MTB 302** **Credit Units: 04**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Course Contents:

Module I: Enzymes
General characteristics of enzymes, Mechanism of action of few enzymes: lysozyme, ribozymes, chymotrypsin and alcohol dehydrogenase.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Multisubstrate systems, Enzyme Inhibitors as therapeutic agents, active site, Isozyme and multienzyme complex.

Module III: Applications of enzymes
Clinical and Industrial, Enzyme Immobilization and its applications.

Module IV: Enzyme Reactors
Reactors for batch/continuous enzymatic processing, Choice of reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design
Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends
Catalytic antibodies, Thermostable enzymes with special references to amylases, lipases and proteases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems by I.H. Segel, Wiley-Interscience
- Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis by R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis by R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer
- Industrial Enzymes & their applications by H. Uhlig, John Wiley and Sons Inc.

DRUG DESIGN AND DEVELOPMENT

Course Code: **MTB 303** **Credit Units: 04**

Course Objective:

The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: ‘de novo’ design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research by J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action” by W.B. Pratt and P. Taylor, Churchill Livingston.

References:

- Principles of Medicinal Chemistry” by W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins.
- Side Effects and Drug Desig by E.J. Lien, Marcel Dekker
- The Anticancer Drugs by W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.

BIOPROCESS PLANT DESIGN

Course Code: **MTB 304** **Credit Units: 03**

Course Objective:

The objective of this paper is to include the application of chemical engineering principles/unit operations to bioprocess systems and the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I
Introduction; general design information; Mass and energy balance.

Module II
Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment.

Module III
Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment.

Module IV
Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries.

Module V
Design of facilities for cleaning of process equipment used in biochemical industries.

Module VI
Utilities of biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Applied Process Design for Chemical and Petrochemical Plants by E.E. Ludwig, Butterworth-Heinemann.
- Chemical Engineering by R.K. Sinnott, J.M. Coulson and J.F. Richardson, Butterworth-Heinemann.

References:
- Chemical Engineers Handbook by R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling by F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers by M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design by E. Bausbacher and R. Hunt, Prentice Hall PTR.

POLLUTION PREVENTION FUNDAMENTALS

Course Code: MTB 305 Credit Units: 03

Course Objective:

To develop an understanding of the methods and impacts of waste minimization including waste pollution prevention and recycling, obtain an overview of relevant environmental laws and regulations governing waste management, understand the phenomena and environmental impact of green-house gases and alternative energy sources to reduce the effect of global warming.

Course Contents:

Module I: Pollution Prevention in Industries
Environment friendly chemical processes-Properties and fates of environmental contaminants- Regulations for clean environment and implications for industries – Improved Manufacturing Operations.

Module II: Life Cycle Assessment and Environmental Audit
Life cycle assessment and pollution prevention economics-Hazard and risk Analysis - Pollution prevention planning - Design for the environment.

Module III: Conservation of Materials and Energy
Water energy and reagent conservation – Residuals management –
Economic Recovery and Recycling of Wastes - Case studies.

Module IV: Total Quality Environment Management and Ems 14000
Municipal pollution prevention programmes –Environment Management System-14000- Systematic, Structured and Documented Response to Environmental Issues- Auditable and Time Targeted Environmental Improvement Programs.

Module V: Hierarchy of Environment Management Practices
Waste-specific pollution prevention: waste pre - generation focus on minimization / recycling, Waste-specific pollution control treatment: pre – generation focus on disposal/ recycling- Waste-specific Post-release-to environment focus: recycling/ remediation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Pollution Prevention: Fundamentals and Practice by Bishop P., McGraw-Hill International Edition, McGraw-Hill book Co, Singapore
- Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner,, Oxford University Press. N.Y.

References:
- Chemical Technology for better Environment by T.K. Roy, (Editor), Allied publishers Ltd, Chennai
- Pollution Prevention through Process Integration: Systematic Design Tools by El Halwagy, M.M, Academic Press, N.Y.

DRUG DELIVERY SYSTEMS

Course Code: MTB 306 Credit Units: 03

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery. Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

IPR, BIOSAFETY AND BIOETHICS

Course Code: **MTB 307** **Credit Units: 03**

Course Objective:

The objectives of the course are to explain the fundamental principles of IPR issues and examine information policy issues from different perspectives. Students will study and assess policy groups, intellectual property rights, access to information and research policy issues that usually include plant, animal and microbial genetic engineering products

Course Contents:

Module I

Objectives of Intellectual Property Rights, origin and evolution of IPR, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Patent, Industrial Design, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties

Module II: IPR

National and international perspective, TRIPS and WIPO

Module III: Patent

Basic criterion for patentability, patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and international perspective, Case study: Basmati case, Neem controversy, Turmeric Case

Module IV: Biosafety

Definition and requirement; biosafety in relation to human health, environment, transgenic research and applications, biosafety laws, guidelines and conventions, biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule ; Regulation bodies at National and International level

Module V

Legal and socioeco'nomic impact of the products and techniques in Biotechnology, Bioethics in plant, animal and microbial genetic engineering, Ethical issues in healthcare, Biopiracy and ethical conflicts

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Coyles information highway handbook; A Practical File on the New Information Order, American Library Association, 2000.
- American Indian Cultural & Research Journal *(UCLA)*

References:

- Refer to Periodicals, Industry directories, Articles and report in journals on the regulatory issues, "Biotechnology" series by Rehm & Reed.

ADVANCED FOOD TECHNOLOGY

Course Code: MTB 308 Credit Units: 03

Course Objective:

The purpose of the Food Technology major is to produce professionals with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research

Course Contents:

Module I

Processing and preservation technologies used in the food industry: heating, drying and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies

Module II

Micro-organisms and their metabolites for food, feed and fuel, development and application of food enzymes: fungal amylases, alpha-amylase, pectinase, amyloglucosidase and catalase. Technology for improvement of the quality of fruit juice through enzymatic treatment, Food spoilage and food poisoning micro-organisms

Module III

Pre- and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage

Module IV

Development of environment-friendly packaging materials based on product characteristics and performance properties of packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminium containers, and retortable pouches based on heat penetration studies and sterilization value

Module V

Food Safety in food service Establishment and other food areas

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Food Technology by Fraziar
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Evaluation Of Certain Food Additives And Contaminants, (WHO Technical Report Series 901) World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland
- International Journal of Food Science & Technology, Blackwell synergy publication
- Bioterrorism and Food Safety by Rasco and Bledsoe.

INDUSTRIAL SAFETY AND MANAGEMENT

Course Code: MTB 309 Credit Units: 03

Course Objective:

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Course Contents:

Module I: Hazards
Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

Module II: Psychology and Hygiene
Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control
Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management
Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

Module V: Laws
Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S .Wood Wiley Interscience,

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

ADVANCED ANIMAL AND PLANT CELL TECHNOLOGY

Course Code: **MTB 310** **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

ADVANCED ANIMAL CELL TECHNOLOGY

Module I

Brief history of animal cell and organ culture, Cultivation of animal cell *en masse* in bioreactor, methods for scale-up, immobilized cell culture, insect cell culture, somatic cell culture, organ culture, and embryo culture.

Module II

Valuable products from cell culture, Production of recombinant tissue-plasminogen-activator, blood factor VIII, erythropoietin, insulin, somatostatin, somatotropin.

Module III

Hybridoma technology, Monoclonal antibodies- production and application, Stem cell technology, custom made animals and tissue engineering

ADVANCED PLANT CELL TECHNOLOGY

Module IV

Brief introduction to various tissue culture techniques,

Cell Cultures, regeneration and preservation: Plant regeneration through meristem, callus (somatic embryogenesis) and anthers. Protoplast culture and somatic hybridization. Production, preservation and use of somatic embryos. Artificial Seeds and Cybrids.

Module V

Induction & utilization of somatic variants; Secondary metabolite production through cell cultures. Principles and the technology, pharmaceutical, secondary metabolites & beverage production; Commercialization of tissue culture technology (Micropropagation). Plant cell reactors. Immobilized plant cell reactors

Module VI

Engineering of Chloroplast and mitochondrial genomes and their applications, Biotransformation by plant cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: MTB 320 **Credit Units: 02**

Course Objective:

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

Course Contents:

Module I

Blood film preparation and identification of cells, Identification of blood group, Isolation of serum.

Module II

Lymphoid organs and their microscopic organization.

Module III

WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test, ELISA:- DOT, SANDWICH

Module IV

Purification of IgG through affinity chromatography

Module V

Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code: MTB 321 **Credit Units: 01**

Course Objective:

To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells

Course Contents:

Module I

Isolation of Enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, acid phosphatase, cellulase, protease.

Module III

Production of enzyme on industrial scale using solid and liquid-state fermentation.

Module IV

Purification of enzyme by ammonium sulphate fractionation, ion-exchange, gel permeation chromatography.

Module V

Enzyme Kinetics: Determination of Michaelis-Menten constant (Km) and Maximum Velocity (Vmax), Temperature optima and pH optima of an enzyme.

Module VI

Enzyme immobilization and its effect on enzyme activity

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

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PROFESSIONAL COMMUNICATIONAL SKILLS

Course Code: MTB 341 **Credit Units: 01**

Course Objective:
To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

Course Contents:

Module I: Mechanics and Semantics of Sentences
Writing effective sentences
Style and Structure

Module II: Developing writing skills
Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

Module III: Business Presentations
Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

Examination Scheme:

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

Text & References:

- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

LEADING THROUGH TEAMS

Course Code: **MTB 343** **Credit Units: 01**

Course Objective:

This course aims to enable students to:
Understand the concept and building of teams
Manage conflict and stress within team
Facilitate better team management and organizational effectiveness through universal human values.

Course Contents:

Module I: Teams: An Overview
Team Design Features: team vs. group
Effective Team Mission and Vision
Life Cycle of a Project Team
Rationale of a Team, Goal Analysis and Team Roles

Module II: Team & Sociometry
Patterns of Interaction in a Team
Sociometry: Method of studying attractions and repulsions in groups
Construction of sociogram for studying interpersonal relations in a Team

Module III: Team Building
Types and Development of Team Building
Stages of team growth
Team performance curve
Profiling your Team: Internal & External Dynamics
Team Strategies for organizational vision
Team communication

Module IV: Team Leadership & Conflict Management
Leadership styles in organizations
Self Authorized team leadership
Causes of team conflict
Conflict management strategies
Stress and Coping in teams

Module V: Global Teams and Universal Values
Management by values
Pragmatic spirituality in life and organization
Building global teams through universal human values
Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

Module VI: End-of-Semester Appraisal
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

Examination Scheme:

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
Weightage (%)	20	05	20	30	25

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - III

Course Code: **MTB 344** **Credit Units: 02**

Course Objective:

To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

Course Contents:

Module B: pp. 76 – 88 Unité 6

Module C: pp. 89 to103 Unité 7

Contenu lexical: **Unité 6: se faire plaisir**

10. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
11. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
12. parler des différentes occasions de faire la fête

Unité 7: Cultiver ses relations

10. maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
11. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
12. caractériser une personne (aspect physique et caractère)

Contenu grammatical:

31. accord des adjectifs qualificatifs
32. articles partitifs
33. Négations avec de, ne…rien/personne/plus
34. Questions avec combien, quel…
35. expressions de la quantité
36. ne…plus/toujours - encore
37. pronoms compléments directs et indirects
38. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
39. Impératif avec un pronom complément direct ou indirect
40. construction avec « que » - Je crois que/ Je pense que/ Je sais que

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- le livre à suivre: Campus: Tome 1

SUMMER PROJECT

Course Code: **MTB 360** **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

10. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

10.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

10.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

10.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

10.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

10.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

10.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

10.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

10.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

10.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

10.10 List of Acronyms and Standards

10.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

10.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

10.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

11. Production of Project Report

11.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

11.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

11.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

11.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

11.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

12. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

12.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

12.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

12.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

12.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

12.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

12.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

12.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article
Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.
For book:
Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.4 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.4.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.4 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

PROJECT

Course Code: MTB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

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The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

The report should be hard bound and for color coding scheme refer NTCC guidelines.

It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(xvi) Long Tables
(xvii) Long quotations
(xviii) Foot notes
(xix) Multilane captions
(xx) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor’s Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar’s signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[16] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[17] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[18] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[19] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[20] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[16] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[17] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[18] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Assessment Scheme:

Continuous Evaluation: 40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Bachelor of Science and Master of Science (Biotechnology) "Dual Degree"

Programme Code: BMB

Duration – 5 Years Full Time

Programme Structure

And

Curriculum & Scheme of Examination

Batch: 2020 – 2025

AMITY UNIVERSITY
MAHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2020

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

New Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses						
BMB 101	Cell Biology	3	-	-	3	
BMB 102	Maths& Biostatistics	3	-	-	3	
BMB 103	Plant Sciences – I	3	-	-	3	
BMB 104	Animal Sciences-I	3			3	
BMB 105	Chemistry – I	3	-	-	3	
BMB 120	Biotechnology Lab - I	-	-	2	1	
BMB 121	Chemistry Lab – I	-	-	2	1	
BMB 122	Plant Sciences Lab - I	-	-	2	1	
BMB 123	Animal Sciences Lab-I			2	1	
	TOTAL				**19**	
Optional Courses - Value Added Courses; Any Three						
BCU 141	Communication Skill - I	1	-	-	1	
EVS 142	Environmental Studies - I	2	-	-	2	
BSU 143	Behavioural Science - I	1	-	-	1	
	Foreign Language - I	2	-	-	2	
FLU 144	French - I					
FLU 145	German					
FLU 146	Spanish					
FLU 147	Japanese					
FLU 148	Chinese					

SECOND SEMESTER

Compulsory Courses						
BMB 201	Introductory Biochemistry & Biophysics	3	1	-	4	
BMB 202	Bioanalytical Techniques	3	-	-	3	
BMB 203	Plant Sciences – II	3	-	-	3	
BMB 204	Animal Sciences-II	2	1		3	
BMB 205	Chemistry – II	3	-	-	3	
BMB 220	Biotechnology Lab – II	-	-	2	1	
BMB 221	Chemistry Lab – II	-	-	2	1	
BMB 222	Plant Sciences Lab – II	-	-	2	1	
BMB 223	Animal Sciences Lab-II	-	-	2	1	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three						
BCU 241	Communication Skill - II	1	-	-	1	
EVS 242	Environmental Studies - II	2	-	-	2	
BSU 243	Behavioural Science - II	1	-	-	1	
	Foreign Language - II	2	-	-	2	
FLU 244	French - II					
FLU 245	German					
FLU 246	Spanish					
FLU 247	Japanese					
FLU 248	Chinese					

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses						
BMB 301	Genetics	3	-	-	3	
BMB 302	Microbiology	4	-	-	4	
BMB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BMB 304	Anatomy & Plant Physiology	3	-	-	3	
BMB 305	Animal Physiology-I	2	1	-	3	
BMB 306	Chemistry – III	3	-	-	3	
BMB 320	Biotechnology Lab – III	-	-	4	2	
BMB 321	Chemistry Lab – III	-	-	2	1	
BMB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BMB 323	Animal Physiology Lab-I	-		2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three						
BCU 341	Communication Skill - III	1	-	-	1	
BSU 343	Behavioural Science - III	1	-	-	1	
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	2	-	-	2	
BMB 330	Term Paper (Evaluation)	-	-	-	2	

FOURTH SEMESTER

Compulsory Courses						
BMB 401	Bioinformatics	3	-	-	3	
BMB 402	Molecular Cell Biology	3	-	-	3	
BMB 403	Immunology & Immunotechnology	4	-	-	4	
BMB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BMB 405	Animal Physiology-II	3	-	-	3	
BMB 406	Chemistry – IV	3	-	-	3	
BMB 420	Biotechnology Lab - IV	-	-	4	2	
BMB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BMB 422	Animal Physiology Lab-II	-	-	2	1	
Optional Courses - Value Added Courses; Any Three						
BCU 441	Communication Skill - IV	1	-	-	1	
BSU 443	Behavioural Science - IV	1	-	-	1	
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	2	-	-	2	

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses						
BMB 501	Plant Biotechnology	3	-	-	3	
BMB 502	Animal Biotechnology	3	-	-	3	
BMB 503	Genomics & Proteomics	3	-	-	3	
BMB 504	Recombinant DNA Technology	3	-	-	3	
BMB 520	Biotechnology Lab - V	-	-	4	2	
BMB 521	Genomics & Proteomics Lab	-	-	4	2	
	TOTAL				**16**	
Optional Courses - Value Added Courses; Any Three						
BCU 541	Communication Skill - V	1	-	-	1	
BSU 543	Behavioural Science - V	1	-	-	1	
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	2	-	-	2	
BMB 550	Summer Training (Evaluation)	-	-	-	5	

SIXTH SEMESTER

Compulsory Courses						
BMB 601	Environmental Biotechnology	4	-	-	4	
BMB 602	Industrial Biology	4	-	-	4	
BCH 623	Principles of Management & Entrepreneurship Development	1	-	-	1	
BMB 620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BMB 660	Project (10-12 Week)	-	-	-	12	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three						
BCU 641	Communication Skill - VI	1	-	-	1	
BSU 643	Behavioural Science - VI	1	-	-	1	
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	2	-	-	2	

SEVEN SEMESTER

New Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses						
BMB701	Advanced Biochemistry	*3*	1	-	4	
BMB702	Advanced Microbial Technology	3	-	-	3	
BMB703	Biophysics & Bioanalytical Techniques	3	-	-	3	
BMB704	Advanced Cell Biology & Genetics	3	1	-	4	
BMB705	Advanced Biostatistics for Biologists	3	-	-	3	
CSE 703	Computer Applications	3	-	-	3	
BMB720	Biochemistry Lab	-	-	4	2	
BMB721	Advanced Microbial Technology Lab	-	-	2	1	
BMB 722	Cell Biology & Genetics Lab	-	-	2	1	
CSE 723	Computer Applications Lab	-	-	2	1	
	TOTAL				**25**	
Optional Courses - Value Added Courses; Any Three						
BCP 741	Advanced Communication - VII	1	-	-	1	
BSP 743	Behavioural Science - VII	1	-	-	1	
 FLP 744 FLP 745 FLP 746 FLP 747 FLP 748	Foreign Language - VII French - VII German Spanish Japanese Chinese	2	-	-	2	

EIGHT SEMESTER

Compulsory Courses						
BMB801	Advanced Molecular Biology	4	-	-	4	
BMB802	Advances in Genetic Engineering	4	-	-	4	
BMB803	Bioprocess Technology	4	-	-	4	
BMB804	Advanced Genomics & Proteomics	4	-	-	4	
BMB805	Computational Biology	3	-	-	3	
BMB806	Environmental Biotechnology	3	-	-	3	
BMB820	Advanced Molecular Biology Lab	-	-	4	2	
BMB821	Genetic Engineering Lab	-	-	4	2	
BMB822	Bioprocess Technology Lab	-	-	4	2	
BMB823	Advanced Genomics & Proteomics Lab			2	1	
BMB824	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three						
BCP841	Advanced Communication - VIII	1	-	-	1	
BSP843	Behavioural Science - VIII	1	-	-	1	
 FLP844 FLP845 FLP846 FLP847 FLP848	Foreign Language - VIII French - VIII German Spanish Japanese Chinese	2	-	-	2	

SUMMER INTERNSHIP OF 09 -12 WEEKS

NINE SEMESTER

Compulsory Courses						
BMB901	Advanced Immunology	3	-	-	3	
BMB902	Enzyme Technology	3	-	-	3	
BMB903	Advanced Animal Biotechnology	3	-	-	3	
BMB904	Advanced Plant Biotechnology	3	-	-	3	
	Elective (Select any One)	3	-	-	3	
BMB905	• Drug Design & Development					
BMB906	• Drug Delivery Systems					
BMB907	• Pharmaceutical Biotechnology					
BMB908	• IPR, Biosafety & Bioethics					
BMB909	• Clinical Biotechnology					
BMB910	• Nanobiotechnology					
BMB911	• Entrepreneurship In Biotechnology					
BMB920	Advanced Immunology Lab	-	-	2	1	
BMB921	Enzyme Technology Lab	-	-	2	1	
BMB922	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
BMB950	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three						
BCP941	Advanced Communication - IX	1	-	-	1	
BSP943	Behavioural Science - IX	1	-	-	1	
	Foreign Language - IX	2	-	-	2	
FLP944	French - IX					
FLP945	German					
FLP946	Spanish					
FLP947	Japanese					
FLP948	Chinese					

TENTH SEMESTER

BMB1060	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

CELL BIOLOGY

Course Code: BMB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the theories given by scientists for the origin of cell along with different types of prokaryotic and eukaryotic cells.
- Know the cellular structure of cell organelle and their functions.
- Differentiate between chromosomal structures in different stages of a cell cycle.
- Understand towards cell differentiation, malignancy and cell death.
- Develop verbal and written skills of subject along with interdisciplinary approach.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology -Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker ,Klinshmith& Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: BMB 102 **Credit Units: 03**

Course Objective:
The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course
Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II
Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III
Measure of central tendency and measure of dispersion
Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution
Simple problems involving Binomial, Poisson and Normal variables,

Module IV
Correlation and regression,
Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:
- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: BMB 103 **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Learning Outcome

1. The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways & mode of reproduction.
2. Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans.
3. Study and acquire knowledge about the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza.
4. Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes.

Course Contents:

Module I: Algae
Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi
Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:,*Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes
Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: BMB 104 **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Learning Outcome

After successful completion of the course student will be able to:

- Learn about characteristics and variations of invertebrates.
- Develop scientific outlook for research and innovation.
- Get knowledge of typical invertebrates and their economic importance.
- Develop conservative outlook for animals.
- Generate written and verbal communication skills over the subject.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.

-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:

-Protozoa: Type study of *Plasmodium.*

-Porifera: Type of *Sycon.*

Module III

-Coelnterata: Type study of *Ovelia.*

-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates

-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*

-Arthropoda: Type Study of *Prawn*

Module V:

Mollusca: Type Study of *Pila*

Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: BMB 105 **Credit Units: 03**

Course Objective:
The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: BMB 120 **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: BMB 121 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Plant Sciences Lab - I

Course Code: BMB 122 **Credit Units: 01**

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Sciences Lab- I

Course Code: BMB 123 **Credit Units: 01**

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	
	Assessment/ Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha, Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.

- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

This course aims at imparting an understanding of:

- Understanding self & process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and its effective on personality
- Building Emotional Competency

Course Contents:

Module I: Self: Core Competency **(2 Hours)**

- Understanding of Self
- Components of Self – Self identity
- Self concept
- Self confidence
- Self image

Module II: Techniques of Self Awareness **(2 Hours)**

- Exploration through Johari Window
- Mapping the key characteristics of self
- Framing a charter for self
- Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness **(2 Hours)**

- Meaning
- Importance
- Components of self esteem
- High and low self esteem
- Measuring your self esteem

Module IV: Building Positive Attitude **(2 Hours)**

- Meaning and nature of attitude
- Components and Types of attitude
- Importance and relevance of attitude

Module V: Building Emotional Competence **(2 Hours)**

- Emotional Intelligence – Meaning, components, Importance and Relevance
- Positive and negative emotions
- Healthy and Unhealthy expression of emotions

Student learning outcomes

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-I

CourseCode: FLU144 **Creditunits: 02**

CourseObjective:
Tofamiliarize studentswiththeFrenchlanguage,withitsphonetic systemanditsaccents.
Toenable students
- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone's family,tastes andpreferences

CourseContents:
Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:
S'adresserpolimentàquelqu'un,entrerencontact,seprésenter,présenterquelqu'un,saluer,poserdesq uestions
simplespourconnaître quelqu'un,épeleret compter
Dossier2:EnfamilleActesdeCommunication:
Parler de sa famille, Décrire quelqu'un, exprimer ses goûts, écrire et comprendre un message court, inviter
quelqu'un,exprimerla possession,la négation
Grammaire :
1. articles indéfinis,articlesdéfinis, masculinetféminindesnomset desadjectifs,pluriel desnomset desadjectifs
2. pronomssujetsettoniques,on,c'est/il est+ profession,
3.masculinet fémininedesadjectifsdenationalité
4. verbes-être,avoir,aller,'er'groupe
5. l'interrogation–l'intonation,est-ce que,quiest-ce ? Qu'est-ce que? L'inversion; où,comment,quand; quel
6. la négation
7. adjectifspossessifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
· Andant,Christineet al.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.
· Andant,Christineet al.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.
Références:
· Girardeau,Brunoet NellyMous.<u>Réussirle DELFA1.</u>Paris: Didier,2010.

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BMB 201 **Credit Units: 04**

Course Objective:
Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Learning Outcome:
After successful completion of the course student will be able to:
* Get familiarize with structures and functions of biomolecules like Carbohydrates, Fats and Nucleic Acids.
* Understand the role of covalent and non-covalent bonds, inter-and intramolecular interactions and their contribution to the native conformation of biomolecules.
* Know the molecular transport within the cell and across membranes and get familiar with the different laws of Physics that are valid in biological systems.
* Calculate energy changes in biological pathways, understand mechanism of light and sound reception.
* Understand how electricity can act as potent signal as well the role of neurotransmitters.

Course Contents:

Module I: Nature of Biological materials
carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules
Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic
Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body
Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments
Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:
- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry -Voet&Voit

BIOANALYTICAL TECHNIQUES

Course Code: BMB 202 **Credit Units: 03**

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the principle and instrumentation of Colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, etc.
- Understand principle instrumentation of chromatographic techniques and their types.
- Principle and applications of electrophoresis I.e., PAGE, Immunoelectrophoresis etc.
- Understand radioisotope tracer techniques and application.
- Develop broad knowledge base, deep theoretical understanding of instruments and their practical implementation in the laboratory

Course Contents:

Module I: Instruments, basic principles and usage
pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques
Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis
Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

PLANT SCIENCES - II

Course Code: BMB 203 **Credit Units: 03**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Learning Outcomes:

1. The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm.
2. The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms.
3. The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms.
4. Know the economic importance of the angiosperm plants.
5. Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas*, *Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

ANIMAL SCIENCES-II

Course Code: BMB 204 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge about Chordates.
- Learn about comparative account of vertebrates.
- Learn about anatomical & physiological variability among vertebrates.
- Generates interdisciplinary and collaborative approach.
- Develops ethical and conservative outlook for animals.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module III: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: BMB 205 **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I

Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II

Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III

Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV

Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V

Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India.

BIOTECHNOLOGY LAB – II (BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: BMB 220 **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BMB 221 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg_2^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^{1+}, K^{1+}, CO_3^{2-}, S^{2-}, SO_3^{2-}, NO_2^{1-}, CH_3COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO_3^{1-}, SO_4^{2-}, $C_2O_4^{2-}$, PO_4^{3-}, BO_3^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: BMB 222 **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: BMB 223 **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear Different types of important edible fishes of India .Study of specimens and slides related to Chordates should be added

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*
Alan Pease : Body Language

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**
Total Hours: 10

Course Objective:

This course aims at enabling students towards:

- Understand the importance of individual differences
- Better understanding of self in relation to society and nation
- Facilitation for a meaningful existence and adjustment in society
- Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

- Personality: Definition& Relevance
- Importance of nature & nurture in Personality Development
- Importance and Recognition of Individual differences in Personality
- Accepting and Managing Individual differences
- Intuition, Judgment, Perception & Sensation (MBTI)
- BIG5 Factors

Module II: Managing Diversity

- Defining Diversity
- Affirmation Action and Managing Diversity **(2 Hours)**
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

Module III: Socialization **(2 Hours)**

- Nature of Socialization
- Social Interaction
- Interaction of Socialization Process
- Contributions to Society and Nation

Module IV: Patriotism and National Pride **(2 Hours)**

- Sense of pride and patriotism
- Importance of discipline and hard work
- Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

- Meaning and Importance of human rights
- Human rights awareness
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

▪Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions
▪Student will be able to understand and respect individual difference, so to enhance the relationship ▪Learn social responsibility and develop a sense of citizenship
▪Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Davis, K. Organizational Behaviour,
- Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- .•Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. Robbins O.B.Stephen;. Organizational Behaviou

Français-II

CourseCode: FLU244 **Creditunits: 02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

CourseContents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:

Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessportsetdes loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:

Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,compareret exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

GENETICS

Course Code: BMB 301 **Credit Units: 03**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the concept of classical genetics including Mendelian laws is easily grasped by students.
- Understand the basic microbial genetics including prokaryotic gene expression and regulation.
- Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept.
- Know various chemical and physical mutagens involved in causing mutation.
- Understand the concept of sex determination and populations genetics.

Course Contents:

Module I

Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II

Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV

Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V

Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI

Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII

Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: BMB 302 **Credit Units: 04**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the microbiological techniques for the isolation and characterization of microbes.
- **Understand the mechanism of different metabolic processes.**
- Know the physiology and survival mechanism of extremophilic bacteria.
- Know the concept of virus lytic and lysogenic cycle is quite clear to students.
- **Understand the epidemiology and microbial pathogenesis.**

Course Contents:

Module I

Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization,

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: BMB 303 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge of biochemical aspects of body.
- Learn about important metabolic pathways and their regulation.
- Deals with pathways responsible for energy production.
- Study of various enzymatic reactions and their role in body.
- Develops collaborative and research approach.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper’s Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin’s Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing.

ANATOMY & PLANT PHYSIOLOGY

Course Code: BMB 304 **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Learning Outcomes:
1. The students will be conceptually integrated to plant internal structure & their functions
2. Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants.
3. The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation.
4. The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students.
5. The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.

Course Contents:

Module I
Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviourof cambium in *Achyranthes, Boerhaavia, Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II
Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III
Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV
Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: BMB 305 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Gain knowledge about functioning of systems of body.
- Generate path for further research and innovation.
- Enhance new collaborative approaches with modern fields of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BMB 306 **Credit Units: 03**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III

Course Code: BMB 320 **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation
Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human
Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.
Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.
Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BMB 321 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO_4^{2+} as $BaSo_4$ ions, iron as F_2O_3 and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BMB 322 **Credit Units: 01**

Course Contents:

Module I: Physiology

Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.

Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.

Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)

Experimentation- Separations of photosynthetic pigments by thin layer chromatography.

Respiration – Determination of R.Q.

Module II: Plant Anatomy

Anatomy of normal dicot and monocot roots, stems & leaves

Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BMB 323 **Credit Units: 01**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.***

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:
To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:
Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:

- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking

- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:

- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking

- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999 •Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998. •Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.

TERM PAPER

Course Code: BMB 330 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.

b) Begin by making a list of subject-headings under which you might expect the subject to be listed.

c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.

b) In research studies, notice the methods and procedures, results & conclusions.

c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.

b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose

b) main body of the paper

c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.

b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.

c) Check for proper spelling, phrasing and sentence construction.

d) Check for proper form on footnotes, quotes, and punctuation.

e) Check to see that quotations serve one of the following purposes:

   (i) Show evidence of what an author has said.

   (ii) Avoid misrepresentation through restatement.

   (iii) Save unnecessary writing when ideas have been well expressed by the original author.

f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%
(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOINFORMATICS

Course Code: BMB 401 **Credit Units: 03**

Course Objective:

The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the structural organization and characteristics of computers and its parts.
- Describe the concept of use of internet in bioinformatics.
- Explain the concept and organization of biological databases.
- Understand and explain the structure and functions of the phylogenetic analytic tools.
- Interrogate major database sources and be able to integrate this information with clinical data.

Course Contents:

Module I: Computers

General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics

Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases

Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module V: Genome analysis

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:

- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: BMB 402 **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information's are stored, expressed and transmitted among generations.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop deep understanding of DNA/ RNA structure, and mechanism of DNA replication.
- Understand Genetic Codes and Transposable elements
- Understand mechanism of transcription and translation in prokaryotes and eukaryotes.
- Enhance fine molecular understanding of operon gene regulation ion in prokaryotes.
- Understand the mechanism of Oncogenes and Tumor suppressor genes.

Course Contents:

Module I: Introduction to Moleculer Biology,

Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.

Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.

Module II:Insertion elements, transposons and retrotransposons

Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.
Application of genetic engineering

Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes

Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.

Module III: Structure of prokaryotic and eukaryotic genes

Transcription mechanism in prokaryotes and eukaryotes.

Translation : Translation mechanisms in prokaryotes and eukaryotes.

Module IV: Gene Expression in prokaryotes

Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)

Module V:Eukaryotic geneExpression

Overview of gene expression, polyadenylation, cap formation, RNA degradation.

Module VI: Oncogenes and Tumor Suppressor genes

Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY & IMMUNOTECHNOLOGY

Course Code: BMB 403 **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the phylogeny of immune system, types of immunity, immune response.
- Describe the concept of clonal selection theory, humoral and cell mediated immunity.
- Understand and explain the structure and functions of the organs and cells of the immune system.
- Understand the mechanism of antigen-antibody interaction.
- Describe the structure of antibodies, their types and functions in immunity.

Course Contents:

Module I

Historical perspective of immune system and immunity; Innate and specific immunity. Humoral immunity, Cell-mediated immunity and Clonal selection theory;

Module II

The organs and cells of the immune system.

Module III

Histocompatibility: structure of MHC class I, II & III antigens & their mode of antigen presentation, MHC restriction; Antigens & antigenicity;

Module IV

Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Antibodies in targeting therapeutic agents. Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application

Module V

Immunoglobulin gene: genetic basis of reation of antibody diversity; Effect of T cell functions.

Module VI

Measurement of antigen – antibody interaction: agglutination, precipitation immunodiffusion, immuno-electrophoresis, ELISA, RIE

Module VII

Tissue and organ transplantation

Module VIII

Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination.

Autoimmunity and autoimmune diseases: Hashimoto’s thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BMB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Learning Outcomes:

1. The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view.
2. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation.
3. The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products.
4. The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them.
5. The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

Course Contents:

Module I
Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.

Module II
Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding

Module III
General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.

Module IV
Economic importance with special reference to plants yielding:
a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
b) Common fibre yielding plants - Cotton, Jute .
c) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
d) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BMB 405 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Understands functioning of important systems of body.
- Develops knowledge about endocrinology and developmental biology.
- Leads to enhance interest in research in advanced biotechnology.
- Exposure with other interdisciplinary subjects of biology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals

- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:

- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:

- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization
-

Module IV:Developmental Biology:

- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: BMB 406 **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic &non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates

Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II

General study of aromatic compounds, orientation of aromatic compounds, aromaticity.

Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III

General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.

Benzene sulphonic acid, sulphanilic acid

Module IV

Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics

Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry

Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry

Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY – IV LAB
(BASED ON BIOINFORMATICS,
MOLECULAR CELL BIOLOGY, IMMUNOLOGY)

Course Code: BMB 420 **Credit Units: 02**

Course Contents:

Module I: Computers
Handling of computers and Data analysis using Oracle (create, append, delete, pack, display, list count, set, order, index, sort)

Module II: Bioinformatics
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.

Module III
Isolation of nuclear DNA (genomic & plasmid DNA)

Module IV
Blood film preparation &identification of blood cells
Study of blood groups
Study of ELISA.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BMB 421 **Credit Units: 01**

Course Contents:

Module I: Embryology
Study of permanent slides of the**:**
a) T.S. anther, pollen, germinating pollen
b) L.S. ovule types
c) Endosperm
d) Embryos
e) L.S. caryopsis
f) Dissection of embryo

Module II:Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code: BMB 422 **Credit Units: 01**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland

- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.

- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMMUNICATION SKILL –IV

Course Code: BCU 441 Credit Units: 1

Course Objective:
This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence** • Resume Writing • Covering Letters • Follow Up Letters	**35% Weightage**
2.	**Module II Dynamics of Group Discussion** • Significance of GD • Methodology & Guidelines	**35% Weightage**
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories** • Proof of the Pudding - O. Henry • “The Lottery” 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	**10% Weightage**
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: *Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer’s Companion, Bedford: St. Martin’s Press, 2010.*
Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building-"New Self awareness.

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.

Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulotActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl'imparfait,comparer(nometverbe),qualifier(qui,que)s' exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. l'imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant, Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.

· Andant, Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:

· Girardeau, Brunoet NellyMous.Réussirle DELFA1

PLANT BIOTECHNOLOGY

Course Code: BMB 501 **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation.

Learning outcomes:

After successful completion of the course student will be able to:

- Handle the basic instruments used in plant biotechnology.
- Learn Preparation of stocks for culture media.
- Learn surface sterilization of different explants
- Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab.
- Get training of problems related to germination, callus induction and propagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Code: BMB 502 **Credit Units: 03**

Course Objective:

The aim of the course is to provide equal importance to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Learning out comes:

After successful completion of the course student will be able to:

- Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial applications.
- Understand scale up production of monoclonal antibodies and hybridoma technology.
- Understand the structure and function of variety of hormones and growth factors.
- Understand the technology and concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks.
- Understand the concept of ethical value regarding the use of animal biotechnology.

Course Contents:

Module I
Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines.

Module II
Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module III
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF,erythropoietin).

Module IV
Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication.

GENOMICS& PROTEOMICS

Course Code: BMB 503 **Credit Units: 03**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Gain understanding of basic structure of protein and its separation by using various techniques.
- Get insight of modeling and *in silico* protein structure building.
- Get understanding of study of protein – protein interaction using various methods.

Course Contents:

GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome :2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BMB 504 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Learning Outcomes:

After successful completion of the course student will be able to:

* Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification.
* Know various methods of introducing DNA into living cells.
* Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells.
* Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy.
* Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

Course Contents:

Module I

Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II

Methods of DNA Introduction into living cells.

Module III

Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV

Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V

Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.

PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene cloning and DNA analysis by T.A. Brown

References:

- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

BIOTECHNOLOGY LAB – V(BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BMB 520 **Credit Units: 02**

Course Contents:

Module I
Sterilization techniques of glass wares &equipments.
Preparation of cotton plugs & culture media .
Preparation and sterilization .of different explants.
Inoculation of explants on culture media.

Module II
Culture of plant embryos/seeds.Callus culture, Testing of seed viability.

Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

Module IV
Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD &*E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BMB 521 **Credit Units: 02**

Course Contents:

Module I
Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II
Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III
Comparison of two given genomes- Mummer.

Module IV
Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer**.**

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

<table>
<tr><td colspan="3">Course Contents / Syllabus:</td></tr>
<tr><td>1.</td><td>Module I Vocabulary
• Define Vocabulary
• Significance of Vocabulary
• One Word Substitution, Synonyms & Antonyms and Idioms & Phrases
• Define and Differentiate Homonyms, Homophones and Homographs
• Vocabulary Drills
• Foreign Words</td><td>35% Weightage</td></tr>
<tr><td>2.</td><td>Module II Comprehension Skills
• Reading Comprehension-SQ3R Reading Techniques
• Summarising and Paraphrasing
• Précis Writing
• Listening Comprehension</td><td>25% Weightage</td></tr>
<tr><td>3.</td><td>Module III Presentation Skills
• Discussing the Significance of Audio-visual Aids, Audience and Feedback in Presentation Skills
• Analyzing the Significance of Non-Verbal Communication</td><td>30% Weightage</td></tr>
<tr><td>4.</td><td>Module IV Prose
• How Far is the River-Ruskin Bond
• My Wood-E.M.Forster
• I have a Dream-Martin Luther King
• Spoken English and Broken English-G.B. Shaw</td><td>10% Weightage</td></tr>
<tr><td>5.

6.</td><td>Student Learning Outcomes:
• Communicate fluently and sustain comprehension of an extended discourse.
• Demonstrate ability to interpret texts and observe the rules of good writing.
• Prepare and present effective presentations aided by ICT tools.
Pedagogy for Course Delivery: Workshop
• Group Discussions
• Presentations
• Lectures</td><td></td></tr>
<tr><td>7.</td><td>Assessment/ Examination Scheme:
<table>
<tr><td>Theory L/T (%)</td><td>Lab/Practical/Studio (%)</td><td>End Term Examination</td></tr>
<tr><td>100%</td><td>NA</td><td>70%</td></tr>
</table>
Theory Assessment (L&T):
<table>
<tr><td>Components (Drop down)</td><td>CIE</td><td>Attendance</td><td>End Term Examination</td></tr>
<tr><td>Weightage (%)</td><td>25%</td><td>5%</td><td>70%</td></tr>
</table></td><td></td></tr>
</table>

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**

Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

_ narratingevents inthe past, markingthestages, usingappropriateconnectors
_ expressingcausesandconsequences, usingappropriate logical connectors
_ presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensembleActesdeCommunication:

Exprimerlacause,l’opposition,laconséquence,décrirelesétapesd’uneaction,s’exprimersurl’environnement ,
l’écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd’une association,fairela biographied’une personne.

Dossiers4, 5,6–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

SUMMER TRAINING (EVALUATION)

Course Code: BMB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and software's, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

- This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BMB 601 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the delicate interrelationship of different components of environment.
- Understand conventional fuels, their impact and concept of clean fuel technology.
- Learn approaches and concepts behind bioremediation xenobiotic compounds, mechanism of microbial leaching and mining.
- Learn the concept of municipal solid and liquid wastes management and EIA.
- Understand the concept and assessment of environmental quality.

Course Contents:

Module I

Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II

Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III

Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV

Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V

Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code: BMB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Develop an understanding of the various aspects of Bioprocess Technology.
- Develop skills associated with screening of Industrially Important Strains and media formulation for industry.
- Understand principles underlying design of fermentor, fermentation process and downstream processing
- Develop an understanding of the various aspects of dairy Technology.
- Understand principles underlying immobilization and their application.

Course Contents:

Module I

Introduction to industrially important microbes, Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II

Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III

Microbial fermentative products, Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, food products from microbes (Dairy &SCP etc)

.

Module IV

Production of fermented dairy products

Module V

Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Industrial Microbiology – Cassida

References:

- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot &Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code: **BMB 620** **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: **BCU 641** **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology).*Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BMB 660 **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

➢ Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

ADVANCED BIOCHEMISTRY

Course Code: BMB 701 **Credit Units: 04**

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn carbohydrate metabolism in detail by analyzing all the pathways.
- Learn the various aspects of lipid metabolism and their regulation.
- Understand the metabolism of Nitrogen and excretion of urea from body.
- Learn Nucleotide metabolism and clinical disorders of purine metabolism.
- Develop advanced knowledge of action of major hormones and principles and application of primary and secondary metabolites.

Course Contents:

Module I

Basics of structures of biopolymers; Carbohydrates, Lipids, Proteins and Nucleic Acids.

Module II

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module III: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module IV: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module V: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module VI: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VII: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), LubertStryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: BMB 702 **Credit Units: 03**

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around us.
- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

Course Contents:

Module I:Introduction to microbiology

Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms

Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics

Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation.Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology

Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings.

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: BMB 703 **Credit Units: 03**

Course Objective:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Learning Outcomes

After successful completion of the course student will be able to:

- Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential.
- Learn about the radiation biophysics and its uses such as tracer techniques etc.
- Learn about various spectroscopic techniques and X –ray crystallography.
- Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein.
- Learn different chromatography and centrifugation techniques for separation of bio-molecules.

Course Contents:

Module I: Membrane Biophysics

Genesis of membrane potential in nerve & membrane, Nerst& Goldman equation, Patch Clamp and Voltage –Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics

Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology

Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography

UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis

Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation

Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- **Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.**

References:

- **Bioinstrumentation, Webster.**
- **Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.**
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: BMB 704 **Credit Units: 04**

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporate elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Learning Outcomes:

After successful completion of the course student will be able to:

* Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations.
* Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles.
* Understand molecular mechanisms of how and why cells move?
* Understand the molecular structure and function of various receptors and mechanism of cell signalling.
* Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.
Extrachromosomal inheritance:,Mitocondrial and chloroplast genetic code
Chromosomal aberration and polyploidy
Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon &nutron) Benzer's work on r II locus in T_2 bacteriophage.
Population genetics- Hardy weinbergsselection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import
Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase,Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer**,** cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: BMB 705 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Learning Outcomes:

Upon course completion, students will be able to understand:

- Fundamental knowledge of basic statistical Techniques.
- Various Statistical Tools used in data presentation and interpretation
- Probability and various distributions.
- Formulation and testing of hypothesis
- Correlation & Regression analysis.
- Analysis of variance(ANOVA)
- Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

II.

III. Course Contents:

IV. Module I:Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III:Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand& Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: CSE 703 **Credit Units: 03**
Total hours: 30

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers (6 Hours)
Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office (5 Hours)
Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system (7 Hours)
Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce (5 Hours)
Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language (7 Hours)
Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF ..
ELSE statements – Loopingconcepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Course Outcomes:

The student will learn

- Work effectively with a range of current, standard, Office Productivity software applications.
- Evaluate, select and use office productivity software appropriate to a given situation.
- Apply basic adult learning and assessment principles in the design, development, and presentation of material produced by office productivity applications.
- Demonstrate employability skills and a commitment to professionalism.
- Operate a variety of advanced spreadsheet, operating system and word processing functions.
- A basic idea of computer programs and its database.

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/Home Assignment, ESE: End Semester Examination;

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj &Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: BMB 720 **Credit Units: 02**

Course Contents:

Module I: Proteins

Identification of protein by Biuret test.
Quantization of protein by Bradford method
Separation of proteins by SDS-PAGE

Module II: Enzyme

Enzyme activity study of serum alkaline phosphates.

Module III: Nucleic Acid

Biochemical estimation of DNA
Biochemical estimation of RNA
Separation of DNA on Arose gel.

Module IV: Carbohydrate

Biochemical estimation of blood sugar

Module V: Lipids

Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ADVANCED MICROBIAL TECHNOLOGY LAB

Course Code: BMB 721 **Credit Units: 01**

Course Contents:

Module I

Aseptic techniques: preparation of culture media for cultivation of specific microorganism.
Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II

Biochemical test - Indole test. methyl red test. vogesproskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III

Isolation of special microbes from environment by isolation and enrichment techniques
Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV

Antibiotic sensitivity test by disc diffusion assay

Module V

Biochemical and molecular characterization of micro organisms
Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: BMB 722 **Credit Units: 01**

Course Contents:

Module I

Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II

Isolation of chloroplast from spinach and study of electron transport chain.

Module III

Isolation of mitochondria and study of electron transport chain.

Module IV

Study of apoptosis by TUNEL method.
Site directed mutagenesis
Mutation detection and analysis
Mitosis
Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: CSE 723 **Credit Units: 01**
Total hours: 20

Course Contents:

Module I: Ms-Office (8 Hours)

Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003 (4 Hours)

Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language (8 Hours)

Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Course Outcomes:

The student will learn

- To operate MS word and its operations and functions
- To know the concepts of DBMS and its query execution.
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

ADVANCED COMMUNICATION-VII

Course Code: BCP 741 **Credit Units: 1**

Course Objective:
The Course is designed to enhance vocabulary skills and make students fluent, thereby improving receptive and expressive skills.
Prerequisites: NIL.
Course Contents / Syllabus:

Module I Fundamentals of Communication.	**30% Weightage**
• Role and Purpose of Communication,7 C's of Communication • Barriers to Effective Communication • Forms of Communication: One-to-One, Informal and Formal	
Module II Oral Communication	**20% Weightage**
• Effective Listening: Principles and Barriers • Effective Speaking: Pronunciation and Accent	
Module III Building Advanced Vocabulary	**20% Weightage**
• Word Formation; Synonyms; Antonyms; Eponyms; Homonyms, Homophones & Homographs • One Word Substitution; Phrasal Verbs, Idiomatic Expressions & Proverbs • Foreign Words in English	
Module IV Non Verbal Communication	**30% Weightage**
• Principles & Significance • Kinesics, Oculesics, Proxemics,, Para-Language, Artifacts, Chronemics, Tactilics	
Student Learning Outcomes	
The students will be able to use the LSRW Skills to communicate effectively in a professional environment.Will be able to develop fluency.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

End Term Examination				
Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Jones, Working in English, 1st ed. Cambridge, CUP 2001*
Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Butterfield, Jeff Soft skills for Everyone, Cengage Learning 2011
Reference: *Guffey, Ellen Mary, Business Communication, Thomson (South Western)*
Dale Carnegie: Quick and Easy Way of Public Speaking
Business Communication Today – Courtland L Bovee, John V Thill Mukesh Chaturvedi, Pearson 2009.
Additional Reading: Newspapers and Journals.

Behavioral Science -VII

Course Code: BSP-743 **Course Credit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

elf and the process of self exploration

- Learning strategies for development of a healthy self esteem
- Importance of attitudes and their effect on work behavior.
- Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self **(2 Hours**)

- Formation of self concept
- Dimension of Self
- Components of self
- Self Competency

Module II: Self-Esteem: Sense of Worth **(2 Hours)**

- Meaning and Nature of Self Esteem
- Characteristics of High and Low Self Esteem
- Importance & need of Self Esteem
- Self Esteem at work
- Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power **(2 Hours)**

- Introduction to EI
- Difference between IQ, EQ and SQ
- Relevance of EI at workplace
- Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence **(2 Hours)**

- Need and importance of Emotions
- Healthy and Unhealthy expression of emotions
- Anger: Conceptualization and Cycle
- Developing emotional and interpersonal competence
- Self assessment, analysis and action Plan.

Module V: Leading Through Positive Attitude **(2 Hours)**

- Understanding Attitudes
- Formation of Attitudes
- Types of Attitudes
- Effects of Attitude on
  1. Behavior
  2. Perception
  3. Motivation
  4. Stress
  5. Adjustment
  6. Time Management
  7. Effective Performance
     Building Positive Attitude.

Student learning outcomes:

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course. Suggested Readings:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.,
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt.Ltd.,
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

Français-VII

CourseCode:FLP744 **CreditUnits:02**

Course Objective:

Tofamiliarizethe studentswiththe Frenchlanguage

- withthe phonetic system
- withtheaccents
- withthemanners
- withthe cultural aspects

Toenablethe students

- toestablishfirstcontacts
- toidentifythingsandtalkaboutthings

CourseContents:

Unité 1,2: pp.01to37

Introductionàlalangue:système phonétique, accents, genre etaccord,jours,mois,nombres

Actesde communication:

Unité 1:Premierscontacts

1. nommerdesobjets,s'adresserpoliment à quelqu'un
2. se présenter, présenterquelqu'un
3. entrerencontact: dire tuouvous,épeler
4. dire oùontravaille,ce qu'onfait
5. communiquersescoordonnées

Unité 2:Objets

1. identifierdesobjets,expliquerleurusage
2. dire ce qu'onpossède,faireunachat,discuterle prix.
3. monteretsituerdesobjets
4. décrire desobjets
5. comparerdesobjets,expliquersespréférences

Grammaire:1.articlesindéfinis,masculinet fémininde snoms,pluriel desnoms
2.Je,il,ellesujets,verbesparler,habiter,s'appeler,être,avoir,masculinet fémínindesadjectifsde nationalité
3.tu,voussujets,verbesparler,aller,être,c'estmoi/c'esttoi
4.verbesfaire,connaître,vendre,c'est/il est +profession,quiest-ce ?qu'est- ce que...?
5.article défini,complément dunom avec de,quel interrogatif
6.adjectifspossessifs(1),pour+ infinitif
7. verbe avoir,ne...pas/pasde,questionavec est-ce que ?,questionnégative, réponse Si
8. Prépositionsdelieu, ilya/qu'est-ce qu'il ya
9 .accordet place desadjectifsqualificatifs,il manque...
10.comparatifsetsuperlatifs, pronomstoniques,pronomon

ExaminationScheme

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weight age (%)	15	10	5	**30**	**70**	

Text &References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

ADVANCEDMOLECULAR BIOLOGY

Course Code: BMB 801 **Credit Units: 04**

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn and develop advanced understanding of mechanism of DNA replication in prokaryotes and eukaryotes.
- Learn the advanced mechanism of transcription in prokaryotes and eukaryotes.
- Develop understanding of various post-transcriptional processes in cell.
- Learn in detail about the mechanism of protein synthesis in prokaryotes and eukaryotes.
- Understand about the advances of gene expression regulation and various mechanisms of gene silencing.

Course Contents:

Module I: DNA replication and repair

DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA

Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA

Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation

Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.

Module V: Regulation of gene expression

Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing

RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme

Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: BMB 802 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes.Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: BMB 803 **Credit Units: 04**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Learning Outcomes:

By the end of the course the student will be able to:

- Develop an understanding of the various aspects of bioprocess technology and their basic principles.
- Develop skills associated with controlling of various parameters of bioprocess monitoring.
- Understand principles underlying design of fermentor, fermentation Process and downstream processing.
- Get knowledge of industrial productions of various primary and secondary metabolites.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium.
Biological heat transfer, Heat transfer coefficients.
Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: BMB 804 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

PART I: GENOMICS

Module I

Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II

Transcriptomics and metatranscriptomics: Introduction , method and uses.genetic mapping

Module III

Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV

Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V

Introduction to proteomics
Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI

Post translationalprotein modification

Module VII

Protein – protein interaction someexamples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: BMB 805 **Credit Units: 03**

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the development of computational biology.
- Describe the fundamentals of bioinformatics databases and their application.
- Understand and explain the use of various computational methods for phylogentic studies
- Use and apply the knowledge of different softwares and programs for sequence comparison, molecular modeling
- Explain the applications of computational biology in different fields of sciences.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

1. Major information Resources & Databases in Bioinformatics
   a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
   b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
   c. Derived (Secondry) Databases of Sequences and structure:
      i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
      ii. SCOP, CATH, DSSP, FSSP, RNAbase,
   d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
2. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
3. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
4. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
5. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
6. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
7. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)
Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.
Suffix tree and its applications in Bioinformatics
Gene Indentification Methods
Predictive Methods using DNA and Protein sequences.
Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.
Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.
Phylogenetics analysis software.
Molecular Structure drawing tool.
Molecular modeling/Docking.
Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- **Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.**

***References*:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BMB 806 **Credit Units: 03**

Course Objective:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I
Environmental pollution and its major impacts on human beings, plants, animals and climate, concept of Global warming and climate change, Global Ozone Problem, Eutrophication, Land degradation, Biomagnification.

Module II
Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III
Biodegradation, Bioremediation and Phytoremediation of major pollutants (PAH, Pesticides etc), Use of microbial technology for mining of metals (Bioleaching) and Concept of Biomineralisation.

Module IV
Waste water engineering: physicochemical characteristic of water, waste water treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V
Bioassessment of environmental quality: Biosensors and biomarkers, Principles of ecotoxicity.
Agriculture Sustainability and Clean agricultural practices: Biofertilizers, Biopesticides and vermi composting

Module VI
Environmental impact assessment and Environmental audit, Related case studies from India.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: BMB 820 **Credit Units: 02**

Course Contents:

1. Isolation of genomic DNA from prokaryotic and Eukaryotes.
2. Isolation of plasmid.
3. Study of DNA protein interaction.
4. Study of in vitro transcription.
5. Study of DNA methylation.
6. Study of DNA repair mechanism.
7. Invitro study of translation
8. Isolation of RNA
9. PCR and Gradient PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: BMB 821 **Credit Units: 02**

Course Contents:

1. Study of gene expression in E.coli.(GFP cloning).
2. Study of Southern Hybridization.
3. Study of RFLP/RAPD.
4. Study of Western blotting.
5. Study of restriction digestion.
6. Study of legation.
7. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: BMB 822 **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: BMB 823 **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II

PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF datausing PDquest software

Module IV

Primer designing, Analysis of protein 3D structures and comparison,.Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: BMB 824 **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Advanced Communication-VIII

Course Code: BCP 841 **Credit Units: 1**

Course Objective:

The course is designed to make the students ready for placement.

Prerequisites: NIL

Module I Job Correspondence	**20% Weightage**
• Job Applications • Resume & Profile Writing for Social Media • Follow Up Letter	
Module II Dynamics of Group Discussion	**30% Weightage**
• Methodology • Guidelines	
Module III Speaking for Employment	**50% Weightage**
• Types of Interview (Technical & HR Rounds) • Fundamentals of Facing Interviews • Question Answer on Various Dimensions • Non-Verbal Communication Component • Interview Etiquettes	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures **Student Learning Outcomes:** The student will be able to write an impressive resume and face the interview confidently.	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100`%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Bovee, L Courtland, Mukesh chaturvedi, and John U Thill, Business Communication Today, Pearson
Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Comfort, Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)
Stay Hungry, Stay Foolish: Rashmi Bansal
Business Maharajas: Gita Piramal
How to Make Friends in Digital Age: Dale Carnegie
Business Communication / Making Connections in a Digital World, Raymond V. Lesikar, Marie E Flattey, Kathryn Rentz, Neerja Pande, Mc Graw Hill, 2009
Additional Reading: Newspapers and Journals.

BEHAVIORAL SCIENCE-VIII

Course Code: BSP-843 **Credit unit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.
- Enhancing personal effectiveness and performance through effective interpersonal communication
- Enhancing their conflict management and negotiation skills.

Course Contents:

Module I: Conflict Management **(2 Hour)**

- Meaning and nature of conflicts
- Types of Conflict
- Styles and Techniques of conflict management
- Conflict management and interpersonal communication

Module II: Behavioral & Interpersonal Communication **(2 Hours)**

- Importance of Interpersonal Communication
- Rapport Building – NLP, Communication mode
- Steps to improve interpersonal communication
- Meaning and Nature of Behavioural Communication

- Relevance of Behavioural Communication

Module III: Relationship Management for Personal and professional Development **(2 Hours)**

- Importance of relationships
- Maintaining healthy relationships
- Communication Styles
- Types of Interpersonal Relationships

Module IV: Stress Management **(2 Hours)**

- Understanding of Stress & GAS Model
- Symptoms of Stress
- Individual and Organizational consequences with special focus on health
- Healthy and Unhealthy strategies for stress management
- Social support for stress management and well being
- Stress free, Successful and Happy Life

Module V: Conflict Resolution & Management **(2 Hours)**

- Conflict Resolution Strategies
- Ways of Managing Conflict (Healthy & Unhealthy)
- Impact of Conflict Resolution & Management

Student learning outcomes

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme.

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course.

Suggested Readings:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel.
- Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
- Harvard Business School, Effective Communication: United States of America.
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

Français-VIII

CourseCode:FLP 844 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictoolstoenable the students

- totalkabouttime schedules
- totalkabouttravel
- toperform simple communicative tasks(fixappointments,makereservations,discusshabits,giveadvice, directions)

CourseContents:
Unité 3, 4: pp. 42 to 72:
Actes de communication:

Unité 3 : Emploi du temps.

1. demanderet donnerl'heure,deshoraires
2. racontersa journée
3. parlerde seshabitudesautravail,de sesloisirs
4. dire la date,parlerdutempsqu'ilfait
5. fixerrendez-vous (autéléphone pare-mail),réserverunetable aurestaurant

Unité 4:Voyage

1. réserverune chambre d'hôtel,demanderla note
2. expliquerunitinéraire
3. parlerde sesdéplacements,situersurune carte
4. exprimerunconseil,uneinterdiction,une obligation
5. acheterunbilletdetrain,consulteruntableaud'horaires

Grammaire:

1.questionavec à quelleheure? adjectifsdémonstratifs
2. verbespronominauxauprésent,lesprépositionsà et de : alleràvenirde
3.adverbesde fréquence, pourquoi...? Parce que ...?
4. expressionindiquant la date, verbesimpersonnels
5. verbe pouvoir+ infinitif,lelundi,lundi prochain
6. adjectifspossessifs(2), adjectiftout
7. impératifprésent(1),nombresordinaux
8. questionsavec est-ce que ? àeten+ moyendetransport,en/au+pays
9.verbesdevoir+infinitif,il faut+ infinitif,ilest interdit de
10.verbes:aller,venir,partir,questionsavec d'où,où,paroù,à quel,de quel.

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

ADVANCED IMMUNOLOGY

Course Code: BMB 901 **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies.
- Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions.
- Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity.
- Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.
Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: BMB 902 **Credit Units: 03**

V.

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Learning Outcomes

Having successfully completed this course, students will be able to:

- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Course Contents:

Module I: Enzymes

Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics

Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes

Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors

Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design

Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends

Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**

- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: BMB 903 **Credit Units: 03**

Course Objective:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Learning out comes:

After successful completion of the course student will be able to:

- Understand conventional and advanced aspects of Animal biotechnology.
- Learn the cell culture media, cell culture methods and their maintenance.
- Identify therapeutic enzymes, strategies of efficient enzyme replacement therapy methods.
- Understand concept of DNA vaccines and other vaccines using animal cell culture.
- Address the concepts and technology behind Gene therapy.
- Learn molecular mechanism of transgenic animal technology., Gene knockout tech.

Course Contents:

Module I
Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II
Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III
DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV
Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V
Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: BMB 904 **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Learning out comes:

After successful completion of the course student will be able to:

- Understand organogenesis, micropropagation, haploid and Embryo resue.
- Develop knowledge of cloning binary and expression vector, transformation in plants.
- Learn molecular techniques for identification of transgenics.
- Understand plant genome organization, gene families and delay of fruit ripening.
- Get knowledge of different biotic and abiotic stress resistant plant development.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques

Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II

Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III

Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV

Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V

Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DESIGN AND DEVELOPMENT

Course Code: BMB 905 **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Learning outcomes:

By the end of the course the student will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: ‘de novo’ design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

DRUG DELIVERY SYSTEMS

Course Code: BMB 906 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).

Module III: Drug administration

Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: BMB 907 **Credit Units: 03**

Course Objective:
The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I
Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II
Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III
DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics,Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs**.**

Module IV
Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations
Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: BMB 908 **Credit Units: 03**

Course Objective:

The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:
- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: BMB 909 **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases.

Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, SignalTransduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections ofNH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change inlight reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), LubertStryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: BMB 910 **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code: BMB 911 Credit Units: 03

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

1. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
2. Organizational Structure and management
3. Capital Management
4. Product innovation and management
5. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

1. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
2. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
3. Basics of material management

Module III

1. Kaizen { Continuous improvement in product and management }
2. Six Sigma
3. Biotech enterprises: Small, Medium and Large.
4. Quality control in Biotech industries.

Module IV

1. Government Regulations for Biotech product.
2. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
3. Business development for medical products.
4. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne& Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

.ADVANCED IMMUNOLOGY LAB

Course Code: BMB 920 **Credit Units: 01**

Course Contents:

1. Purification of immunoglobin G.
2. Study of antigen- antibody pattern (ODD).
3. Study of sandwich ELISA.
4. Study of haemeagglutination.
5. Study of immunoelectrophoresis.
6. Isolation and identification of rosette cells.
7. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ENZYME TECHNOLOGY LAB

Course Code: BMB 921 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: BMB 922 **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

1. Histological study of important animal tissues.
2. Estimation of enzyme activity from animal tissues.
3. Study of toxicity on invitro model.
4. Culture and maintenance of animal cell lines.
5. Culture of chickenfibroblasts.
6. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

1. Tissue culture lab and organization.Sterilisation of glasswares, tools and equipments.
2. Preparation of stocks and media.Surface sterilization of various explants
3. ORGAN CULTURE
4. Cllus culture
5. Anther culture
6. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED COMMUNICATION –IX

Course Code: BCP 941 **Credit Units: 01**

Course Objective:

The course is designed to develop competence in communication skills related to production & presentation of messages in multiple formats & understand the importance of body language.

Prerequisites: NIL

Module I Written Communication	**40% Weightage**
• Coherence and Structure • Précis Writing • Writing Paragraphs & Essays	
Module II Developing Writing Skills	**30% Weightage**
• Business Letter/Official Correspondence • Social Correspondence • Emails & Netiquette	
Module III Business Presentations	**30% Weightage**
• Planning, Design and Layout of Presentation • Contents : Information Packaging & Delivery • Personal Branding	
Student Learning Outcomes	
The student will be able to write impressive official correspondence and also learn to make and give effective presentations in a professional environment.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Lesikar & Flatley, Basic Business Communication, Tata McGraw- Hill Edition

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)

Business Communication for Managers, Payal Mehra Pearson 2012

Additional Reading: Newspapers and Journal

BEHAVIOURAL SCIENCE – IX

Course Code: BSP-943 **Course Credit: 01**

Total Hours: 1

Course Objective:

This course will help the students to:

- Importance of Personal and Professional excellence
- Inculcating the components of excellence
- Explore interest, attitude and Explore career opportunities
- Set career goals

Course Contents:

Module I: Professional Competence **(2 Hours)**

- Understanding Professional Competence
- Component of Competence:
  - Knowledge
  - Skills
  - Attitude
  - Self awareness
  - Self Promotion & Presentation,
  - Self confidence
  - Skills
  - Performance
- Political awareness, Coping with uncertainty
- Developing positive attributes at work place (personal and professional)
- Time management
- Handling criticism and interruptions
- Managing difficult people

Module II: Managing Personal Effectiveness **(2 Hours)**

- Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness)
- Integration of personal and organizational vision for effectiveness
- A healthy balance of work and play

Module III: Components of Excellence **(2 Hours)**

- Positive Imagination & Focused
- SMART Goal
- Controlling Distraction
- Commitment
- Constructive Evaluation
- Creativity & Success

Module IV: Career Development **(2 Hours)**

- Understanding Development Process
- Knowing and assessing one's Interest
- Knowing and assessing one's Aptitude
- Selecting from available resources
- Career planning and development

Module V: Personal & Professional Success **(2 Hours)**

- Career Selection & Motivation.
- Action planning Networking Negotiation.
- Accept Change & Challenge for Successful career.

Student learning outcomes:

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers
- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan, D. (2005). Information and Knowledge Management, Macmillan India Ltd. Delhi

Français-IX

CourseCode:FLP 944 **CreditUnits:02**
CourseObjective:

Tofurnishthelinguistictools
_ totalkaboutwork andproblemsrelatedtowork
_ toperform simple communicative tasks(explaininga setback,askingforapostponementofappointment,give instructions,place orders,reserve, holda telephone conversation,write e-mails,replytomessages)
_ toprepare arésumé andtoappearforinterviews

CourseContents:

Unité 5, 6:pp. 74to104

Actesde communication:

Unité 5:Travail

1. mangeraurestaurant,comprendreunmenu,commander
2. engagerune conversationtéléphonique
3. présentersonrésumé: parlerde sa formation,de sonexpérience,de ses compétences
4. raconterdesévénementspassés
5. consultersa boîte e-mails,répondreauxmessages

Unité 6:Problèmes

1. identifierunproblème,demanderdesprécisions
2. expliqueruncontretemps,déplacerunrendez-vous
3. demanderde l'aide (partéléphone,pare-mail)
4. donnerdesinstructions
5. expliquerunproblème,suggérerunesolution.

Grammaire :

1. futur proche, articles partitifs, un peu de, beaucoup de, une bouteille de, Un morceau de.
2. pronoms COD, venir de + infinitif, verbes appeler (au présent)
3. passé composé avec avoir, affirmatif et interrogatif, savoir et connaître
4. passé composé avec être, accord du participe passé, négation
5. pronoms COI, être en train de
6. ne…rien, ne…personne, ne…plus, ne…pas encore, qu'est-ce que/ qu'est-ce qui/qui est-ce que/qui est-ce qui.
7. passé composé des verbes pronominaux.
8. si/quand+présent, ne…plus, ne …pas encore.
9. impératif présent (2) place du pronom et verbes pronominaux.
10. Trop /pas assez, verbe devoir au conditionnel présent.

Examination Scheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage (%)	15	10	5	**30**	**70**	**100**

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

SUMMER INTERNSHIP

Course Code: BMB 950 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography
Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).
Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report
2.1 Report Size
The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size
The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing
It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material
Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding
First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report
After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font
For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: BMB 1060 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.
This does not include the page count of the appendices.
With regard to the text please note:
Color: Black on white
Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time
- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.
The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.
It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.
The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?
Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY

M A D H Y A P R A D E S H

Bachelor of Science Biology

Programme Code: BSC

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2020 -2023

AMITY UNIVERSITY
MADHYA PRADESH
PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

The programme is enabled with wide range of teaching and learning methods including, class room sessions, seminars, quizzes, industrial and academic visits, workshops, guest lectures etc., to further capacity building of the students.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is belief that the provided information will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.July 2020

PROGRAMME OBJECTIVE

B.Sc. (Biology) is three year degree programme spread into six semesters, which offers perfect combination of core basic biological sciences courses along with chemistry with emphasis on advanced techniques in the area of biology that are holding importance not only in basic science research but also for industrial relevance. The programme is structured to impart knowledge and skills to young students to build up strong theoretical and practical knowledge to strengthen the research and development in biological science and develop excellent professionals for academics, research institutions and industries.

The last semester of curriculum is primarily dedicated to dissertation (A small full time research project) which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental of basic biology and its applied aspects. Each subject of the programme besides focusing on theoretical aspects, it is also adequately supported by practicals conducted in well equipped laboratories. This programme offers some of the core subjects of biological sciences under the broad subject category of like Zoology, Botany, and Chemistry which consisting of Taxonomy, Diversity, Developmental biology, Physiology, Biochemistry, Cell biology, Reproduction and Biotechnology for animal as well as plants. The major highlight of the course is the extensive discussion of the life forms and various domains of living processes of plant, animal and microbes. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biological sciences.

PROGRAMME STRUCTURE (B.Sc. Biology)

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses						
BSC101	Plant Sciences – I	4	-	-	4	
BSC102	Animal Sciences-I	4			4	
BSC103	Chemistry – I	4	1	-	5	
BSC120	Plant Sciences Lab - I	-	-	4	2	
BSC121	Animal Sciences Lab-I	-	-	**4**	**2**	
BSC122	Chemistry Lab – I	-	-	4	2	
	TOTAL				**19**	
Optional Courses - Value Added Courses; Any Three						
BCU141	Communication Skill - I	1	-	-	1	
EVS142	Environmental Studies - I	2	-	-	2	
BSU143	Behavioural Science - I	1	-	-	1	
	Foreign Language - I	2	-	-	2	
FLU 144	French - I					
FLU 145	German					
FLU 146	Spanish					
FLU 147	Japanese					
FLU 148	Chinese					

SECOND SEMESTER

Compulsory Courses						
BSC201	Plant Sciences – II	4	-	-	4	
BSC202	Animal Sciences-II	4	-		4	
BSC203	Chemistry – II	4	1	-	5	
BSC220	Plant Sciences Lab – II	-	-	4	2	
BSC221	Animal Sciences Lab-II	-	-	**4**	**2**	
BSC222	Chemistry Lab – II	-	-	4	2	
	TOTAL				**19**	
Optional Courses - Value Added Courses; Any Three						
BCU241	Communication Skill - II	1	-	-	1	
EVS242	Environmental Studies - II	2	-	-	2	
BSU243	Behavioural Science - II	1	-	-	1	
	Foreign Language - II	2	-	-	2	
FLU 244	French - II					
FLU 245	German					
FLU 246	Spanish					
FLU 247	Japanese					
FLU 248	Chinese					

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses						
BSC301	Anatomy & Plant Physiology	4	-	-	4	
BSC302	Animal Physiology-I	4	-	-	4	
BSC303	Chemistry – III	4	1	-	5	
BSC320	Anatomy & Plant Physiology Lab	-	-	4	2	
BSC321	Animal Physiology Lab-I	-	-	4	2	
BSC322	Chemistry Lab – III	-	-	4	2	
BSC 330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three						
BCU341	Communication Skill - III	1	-	-	1	
BSU343	Behavioural Science - III	1	-	-	1	
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	2	-	-	2	

FOURTH SEMESTER

Compulsory Courses						
BSC401	Plant Breeding, Embryology, Pathology & Economic Botany	4	-	-	4	
BSC402	Animal Physiology-II	4	-	-	4	
BSC403	Chemistry – IV	4	1	-	5	
BSC420	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	4	2	
BSC421	Animal Physiology Lab-II	-	-	**4**	**2**	
BSC422	Chemistry Lab-IV			4	2	
	TOTAL				**19**	
Optional Courses - Value Added Courses; Any Three						
BCU441	Communication Skill - IV	1	-	-	1	
BSU443	Behavioral Science - IV	1	-	-	1	
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	2	-	-	2	

FIFTH SEMESTER

Compulsory Courses						
BSC501	Plant Biotechnology	4	-	-	4	
BSC502	Genetics & Animal Biotechnology	4	-	-	4	
BSC503	Chemistry – V	4	1	-	5	
BSC520	Plant Biotechnology Lab	-	-	4	2	
BSC521	Genetics & Animal Biotechnology Lab	-	-	4	2	
BSC522	Chemistry Lab V	-	-	4	2	
	TOTAL				**19**	
Optional Courses - Value Added Courses; Any Three						
BCU 541	Communication Skill - V	1	-	-	1	
BSU 543	Behavioural Science - V	1	-	-	1	
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	2	-	-	2	

SIXTH SEMESTER

Compulsory Courses						
BSC601	Plant Ecology	3	1	-	4	
BSC602	Applied Zoology	3	1	-	4	
BSC603	Chemistry – VI	3	1	-	4	
BCH623	Principles of Management & Entrepreneurship Development	2	-	-	2	
BSC620	Plant Ecology and Applied Zoology Lab	-	-	4	2	
BSC621	Chemistry Lab VI	-	-	4	2	
BSC 660	Project (10-12 Week)		-	-	12	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three						
BCU641	Communication Skill – VI	1	-	-	1	
BSU643	Behavioural Science – VI	1	-	-	1	
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	2	-	-	2	

Plant Sciences - I

Course Code: BSC 101 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Learning Outcome

1. The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways & mode of reproduction.
2. Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans.
3. Study and acquire knowledge about the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza.
4. Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes.

Course Contents:

Module I: Algae

Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:

Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi

Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:,*Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes

Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes

Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: BSC 102 **Credit Units: 04**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Learning Outcome

After successful completion of the course student will be able to:

- Learn about characteristics and variations of invertebrates.
- Develop scientific outlook for research and innovation.
- Get knowledge of typical invertebrates and their economic importance.
- Develop conservative outlook for animals.
- Generate written and verbal communication skills over the subject.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.

-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:

-Protozoa: Type study of *Plasmodium.*

-Porifera: Type of *Sycon.*

Module III

-Coelnterata: Type study of *Ovelia.*

-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates

-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting*,

-Arthropoda: Type Study of *Prawn*

Module V:

Mollusca: Type Study of *Pila*

Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: **BSC 103** **Credit Units: 05**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic bonding mechanism and the application to materials in different field.
- To understand the Chemical properties and basic bonding behavior of Radioactive elements
- To understand the Chemical properties and basic bonding behavior of inorganic chemistry elements
- To understand the Chemical Kinetics, Gas Kinetics, Gas behavior, rate of reaction

Course Contents:

INORGANIC

Module I

Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II

Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III

Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV

Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V

Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI

Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

Plant Sciences Lab - I

Course Code: BSC 120 **Credit Units: 02**

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Sciences Lab- I

Course Code: BSC 121 **Credit Units: 02**

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

CHEMISTRY LAB - I

Course Code: BSC 122 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I

Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$

Module II

Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.

Module III

Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV

Determination of surface tension and viscosity of liquids

Module V

Heat of neutralisation of a strong acid and a strong base.

Module VI

Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	
	Assessment/ Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha, Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community

ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.

- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

This course aims at imparting an understanding of:

- Understanding self & process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and its effective on personality
- Building Emotional Competency

Course Contents:

Module I: Self: Core Competency **(2 Hours)**

- Understanding of Self
- Components of Self – Self identity
- Self concept
- Self confidence
- Self image

Module II: Techniques of Self Awareness **(2 Hours)**

- Exploration through Johari Window
- Mapping the key characteristics of self
- Framing a charter for self
- Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness **(2 Hours)**

- Meaning
- Importance
- Components of self esteem
- High and low self esteem
- Measuring your self esteem

Module IV: Building Positive Attitude **(2 Hours)**

- Meaning and nature of attitude
- Components and Types of attitude
- Importance and relevance of attitude

Module V: Building Emotional Competence **(2 Hours)**

- Emotional Intelligence – Meaning, components, Importance and Relevance
- Positive and negative emotions
- Healthy and Unhealthy expression of emotions

Student learning outcomes

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	**5**	**10**	**15**	**70**	**100**

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-I

CourseCode: FLU144 **Creditunits: 02**

CourseObjective:
Tofamiliarize studentswiththeFrenchlanguage,withitsphonetic systemanditsaccents.
Toenable students

- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone’sfamily,tastes andpreferences

CourseContents:
Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:
S’adresserpolimentàquelqu’un,entrerencontact,seprésenter,présenterquelqu’un,saluer,poserdesquestions
simplespourconnaître quelqu’un,épeleret compter
Dossier2:EnfamilleActesdeCommunication:
Parler de sa famille, Décrire quelqu’un, exprimer ses goûts, écrire et comprendre un message court, inviter
quelqu’un,exprimerla possession,la négation
Grammaire :
1. articles indéfinis,articlesdéfinis, masculinetfémânindesnomset desadjectifs,pluriel desnomset desadjectifs
2. pronomssujetsettoniques,on,c’est/il est+ profession,
3.masculinet fémânindesadjectifsdenationalité
4. verbes-être,avoir,aller,‘er’groupe
5. l’interrogation–l’intonation,est-ce que,quiest-ce ? Qu’est-ce que? L’inversion; où,comment,quand; quel
6. la négation
7. adjectifspossessifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
· Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
· Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.
Références:
· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

PLANT SCIENCES - II

Course Code: BSC 201 **Credit Units: 04**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Learning Outcomes:

1. The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm.
2. The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms.
3. The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms.
4. Know the economic importance of the angiosperm plants.
5. Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

ANIMAL SCIENCES-II

Course Code: BSC 202 **Credit Units: 04**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge about Chordates.
- Learn about comparative account of vertebrates.
- Learn about anatomical & physiological variability among vertebrates.
- Generates interdisciplinary and collaborative approach.
- Develops ethical and conservative outlook for animals.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module III: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: BSC 203 **Credit Units: 05**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic Stereochemistry, Structure, Bonding mechanism & Molar mass so that application of materials in different field can be understood.
- To learn & understand the Quantitative & Qualitative analysis of Elements Estimation
- To understand the Nomenclature of various Organic Compounds
- To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale
- To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale
- To learn and understand chemical equilibrium and electrochemistry for various applications

Course Contents:

ORGANIC CHEMISTRY

Module I

Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II

Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III

Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV

Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V

Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin’s Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India.

PLANT SCIENCES LAB - II

Course Code: BSC 220 **Credit Units: 02**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: BSC 221 **Credit Units: 02**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear Different types of important edible fishes of India .Study of specimens and slides related to Chordates should be added

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BSC 222 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I

Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg_2^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^{1+}, K^{1+}, CO_3^{2-}, S^{2-}, SO_3^{2-}, NO_2^{1-}, CH_3COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO_3^{1-}, SO_4^{2-}, $C_2O_4^{2-}$, PO_4^{3-}, BO_3^{3-}.

Module II

Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*
Alan Pease : Body Language

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)
Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)
From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)
Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)
Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**
Total Hours: 10

Course Objective:

This course aims at enabling students towards:

- Understand the importance of individual differences
- Better understanding of self in relation to society and nation
- Facilitation for a meaningful existence and adjustment in society
- Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

- Personality: Definition& Relevance
- Importance of nature & nurture in Personality Development
- Importance and Recognition of Individual differences in Personality
- Accepting and Managing Individual differences
- Intuition, Judgment, Perception & Sensation (MBTI)
- BIG5 Factors

Module II: Managing Diversity

- Defining Diversity
- Affirmation Action and Managing Diversity **(2 Hours)**
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

Module III: Socialization **(2 Hours)**

- Nature of Socialization
- Social Interaction
- Interaction of Socialization Process
- Contributions to Society and Nation

Module IV: Patriotism and National Pride **(2 Hours)**

- Sense of pride and patriotism
- Importance of discipline and hard work
- Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

- Meaning and Importance of human rights
- Human rights awareness
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

▪Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions
▪Student will be able to understand and respect individual difference, so to enhance the relationship ▪Learn social responsibility and develop a sense of citizenship
▪Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

•Davis, K. Organizational Behaviour,
•Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour
•Dressler, David and Cans, Donald: The Study of Human Interaction
.•Lapiere, Richard. T – Social Change
•Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
•Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. Robbins O.B.Stephen;.
Organizational Behaviou

Français-II

CourseCode: FLU244 **Creditunits: 02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

CourseContents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:

Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessportsetdes loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:

Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,compareret exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

ANATOMY & PLANT PHYSIOLOGY

Course Code: BSC 301 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Learning Outcomes:

1. The students will be conceptually integrated to plant internal structure & their functions
2. Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants.
3. The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation.
4. The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students.
5. The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.

Course Contents:

Module I

Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviourof cambium in *Achyranthes*, *Boerhaavia*, *Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II

Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III

Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV

Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:

- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: BSC 302 **Credit Units: 04**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Gain knowledge about functioning of systems of body.
- Generate path for further research and innovation.
- Enhance new collaborative approaches with modern fields of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSC 303 **Credit Units: 05**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic Structure, Bonding mechanism and application of materials in different field
- To learn & understand the acid and basic concept
- To understand the concepts of Coordination Chemistry
- To understand the synthesis, properties and application of various inorganic acids in various field
- To understand Phase Equilibria law and its application in various field like purification, precipitation, and understanding temperature behavior, and various states of any system

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BSC 320 **Credit Units: 02**

Module I: Physiology
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.
Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.
Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)
Experimentation- Separations of photosynthetic pigments by thin layer chromatography.
Respiration – Determination of R.Q.
Module II: Plant Anatomy
Anatomy of normal dicot and monocot roots, stems & leaves
Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSC 321 **Credit Units: 02**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BSC 322 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO_4^{2+} as $BaSo_4$ ions, iron as F_2O_3 and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **Credit Units: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:
To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:
Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.

TERM PAPER

Course Code: BSC 330 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.

f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.

[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSC 401 **Credit Units: 04**

Course Objective:

To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Learning Outcomes:

1. The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view.
2. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation.
3. The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products.
4. The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them.
5. The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

Course Contents:

Module I

Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.

Module II

Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding

Module III

General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.

Module IV

Economic importance with special reference to plants yielding:

a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
b) Common fibre yielding plants - Cotton, Jute .
c) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
d) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BSC 402 **Credit Units: 04**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Understands functioning of important systems of body.
- Develops knowledge about endocrinology and developmental biology.
- Leads to enhance interest in research in advanced biotechnology.
- Exposure with other interdisciplinary subjects of biology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals

- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:

- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:

- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization

Module IV:Developmental Biology:

- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole"s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: BSC 403 **Credit Units: 05**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic &non aromatic compounds and their uses.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic structure, bonding, reaction mechanism and application of various organic compounds like carbohydrates, aromatic compounds, aromatic hydrocarbons
- To understand Chemical Thermodynamics, Electrochemistry & Photochemistry concepts

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates

Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II

General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III

General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV

Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics

Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry

Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry

Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSC 420 **Credit Units: 02**

Course Contents:

Module I: Embryology

Study of permanent slides of the**:**

a) T.S. anther, pollen, germinating pollen
b) L.S. ovule types
c) Endosperm
d) Embryos
e) L.S. caryopsis
f) Dissection of embryo

Module II:Plant Pathology

Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany

Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code: BSC 421 **Credit Units: 02**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland

- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.

- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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CHEMISTRY LAB - IV

Course Code: BSC 422 **Credit Units: 02**

Course Contents:

ORGANIC CHEMISTRY

Module I

Synthesis of Organic Compounds

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone.
Benzoylation of aniline and phenol.
(b) Aliphatic electrophilic substitution.
Preparation of iodoform from ethanol and acetone.
(C) Aromatic electrophilic substitution

Nitration

Preparation of m-dinitrobenzene
Preparation of p-nitro acetanilide

Halogenation

Preparation of p-Bromo acetanilide
Preparation of 2,4,6-tribromophenol.
(d) Diazotization/coupling
Preparation of methyl orange and methyl red
(e) Oxidation
Preparation of benzoic acid from toluene
(f) Reduction
Preparation of aniline from nitrobenzene
Preparation of aniline from nitrobenzene
Preparation of m-nitroaniline from m-dinitrobenzene

Module II

Stereochemical Study of Organic Compounds via Models

R and S configuration of optical isomers.
E and Z configuration of geometrical isomers.
Conformational analysis of cyclohexane's and substituted cyclohexane's.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • “The Lottery” 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: *Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: *Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.*
Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building-"New Self awareness.

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.

Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulotActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’ exprimer autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

1. l’imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant, Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.
- Andant, Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:

- Girardeau, Brunoet NellyMous.Réussirle DELFA1

PLANT BIOTECHNOLOGY

Course Code: BSC 501 **Credit Units: 04**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation.

Learning outcomes:

After successful completion of the course student will be able to:

- Handle the basic instruments used in plant biotechnology.
- Learn Preparation of stocks for culture media.
- Learn surface sterilization of different explants
- Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab.
- Get training of problems related to germination, callus induction and propagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

GENETICS & ANIMAL BIOTECHNOLOGY

Course Code: BSC 502 **Credit Units: 04**

Course Objective:

The objectives of the course is to focus on the concepts of Gene and mutation, molecular genetics, *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept.
- Know various chemical and physical mutagens involved in causing mutation.
- Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial applications.
- Understand scale up production of monoclonal antibodies and hybridoma technology.
- Understand the structure and function of variety of hormones and growth factors, concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks.

Course Contents:

Module I

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module II

Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module III

Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines. Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module IV

Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF,erythropoietin). Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.
- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication. Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.

CHEMISTRY - V

Course Code: BSC 503 **Credit Units: 05**

Course Objective:

The students will learn about the various laws and conditions related to quantum mechanics, behavior of acid & base, metal & metal complexes and organometallic compounds

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences

- To understand the very basic bonding mechanism and the application to materials in different field.
- To understand the concept of Quantum Chemistry and its application
- To understand Hard & Soft Acid and Base concepts and its application
- To understand Organometallic & Bioorganic Concept

Physical Chemistry

Module I: Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect.
De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interprtation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.
Molecular orbital theory, basis ideas - criteria for forming M.O. from A.O., construction of M.O. 's LCAO-H2+ ion, calculation of energy levels from wave functions, concept of α, α^* π, π^*orbitals and their characteristics, Hybrid orbitls-SP, SP^2, SP^3 ; calculation of coefficients of A.O.'s used in these hybrid orbitals.
Introduction to valence bond model of H2, comparison of M.O. and V.B. models.

Inorganic Chemistry

Module II: Hard and Soft Acids and Bases (HSAB) & Silicones and Phosphazenes
Hard and Soft Acids and Bases (HSAB)

Classification of acids and baes as hard soft. Pearson's HSAB concept , acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativityand hardness and softness.

Silicones and Phosphazenes

Silicones and phosphazenes as examples of inorganic, polymers, nature of bonding in triphosphazenes.

Module III: Metal-ligand Bonding in Transition Metal Complexes

Limitations of Valence bond theor, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes, factors affecting the crystal -field parameters.

Theromodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic satbility of metal complexes and factors affecting the stability, substitution: reactions of square planer complexes.

Module IV: Magnetic Properties of Transition Metal Complexes

Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of µs (spin only) and µeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Electron Spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy Level diagram for d1 and d9 states, discussion of the electronic specturm of [Ti(H2O)6]3+ complexion.

Module V Organometallic Chemistry

Definition, nomenclature and classification of organometallic componds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogenous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Module VI: Bioinorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca2+. Nitrogen fixation.

Text & References:

Text:

1. Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
2. Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.
3. Principles Of Bioinorganic Chemistry Paperback – 1997, Jeremy M Berg Stephen J Lippard

References:

1. Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand &Co. Ltd.
2. Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
3. Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
4. Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.
5. Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
6. Atkin's Physical Chemistry, Atkin, Oxford Press.
7. Physical Chemistry, Vemulapalli, Printice Hall of India

PLANT BIOTECHNOLOGY

Course Code: BSC 520 **Credit Units: 02**

Module I
Sterilization of glasswares and equipments.
Preparation of cotton plugs and culture media
Preparation of stocks for culture media
Preparation of culture media

Module II
Preparation and sterilization of different explants
Inoculation of explants on culture media

Module III
Study of viability of seeds

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS & ANIMAL BIOTECHNOLOGY LAB

Course Code: BSC 521 **Credit Units: 02**

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation
Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human
Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - V

Course Code: BSC 522 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I

Synthesis and Analysis

(a) Preparation of sodium trioxalato ferrate (III), $Na_3 [Fe(C_2O_4)_3]$ and determination of its composition by permagnatometry.
(b) Preparation of Ni-DMG complex [Ni $(DMG)_2$].
(c) Preparation of copper tetraamine complex, $[Cu(NH_3)_4]SO_4$.
(d) Preparation of cis-and trans-bisoxalato diaqua chromate (III) ion.

Instrumentation

Colorimetry

(a) Job's method, **(b)** Mole-ration method
Adulteration-Food stuffs, Effluent analysis, water analysis

Solvent Extraction

Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method

Separation and estimation of Mg(II) and Zn(II)

PHYSICAL CHEMISTRY

Module II

Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g. MnCl2. 4H2O/ SrBr2. 2H2O).

Phase Equilibrium

2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that soluble in the given phenol-water system.
3. To construct the phase diagram of two component (e.g. diphenylamine- benzophenone) system by cooling curve method.

Thermochemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine DH of the dissolution process.
2. To determine the enthalpy of neutralization of a week acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionisation of the weak acid/ weak base.
3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber Cycle.

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Vocabulary** • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	**35% Weightage**
2.	**Module II Comprehension Skills** • Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	**25% Weightage**
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in Presentation Skills • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools.	
6.	**Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten
Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready
Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

_ narratingevents inthe past, markingthestages, usingappropriateconnectors
_ expressingcausesandconsequences, usingappropriate logical connectors
_ presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensembleActesdeCommunication:
Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement
,
l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision
Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

PLANT ECOLOGY

Course Code: BSC 601 **Credit Units: 04**

Course Objective: The paper is designed for developing understanding of modern ecological processes and factors affecting growth and distribution of vegetation, principles of management of natural resources through holistic approach. The distribution of population of different species, their dynamics, communities and ecosystems.

Learning Outcome:

1. The students will develop an understanding of modern ecological concepts through holistic approach about populations, communities and ecosystems
2. Would provide information about various ecological processes and factors affecting growth and distribution of vegetation, principles of management of natural resources
3. Identify the significance of plant cover as an indicator of change in the environment, and as an active participant in the formation of environmental conditions or habitat types.
4. The course content will help the students to analyse the interrelationships of all the biotic and abiotic components with the environmental conditions, with independent recognition and classification of taxa.
5. The students will develop the expertise in differentiating properties of terrestrial, aquatic and marine ecosystems and the accompanying communities.

Unit-I

Introduction to the Biosphere: Inter-relationships between the living world and the environment, the components and dynamism, Homeostasis. Environment factors, Climatic factors: Composition and stratification of atmosphere, Topographic factors, Edaphic factors, Biotic factors.

Unit-II

Levels of Organization, Population and Communities: concepts of autecology, synecology; concept of biological diversity; habital and ecological niche. Distribution and characteristics of populations; population dynamics; Ecological Speciation. Community characters (analytical and synthetic), ecotone and edge effect; plant succession, processes, type; primary and secondary succession; climax concepts.

Unit-III

Ecosystems: Structure, biotic and the abiotic components; trophic organization, source of energy, autotrophy, heterotrophy, parasitism; food chains and webs; ecological pyramids; biomass. Energy flow; biogeochemical cycles; dynamics: hydrologic cycle; gaseous cycles, sedimentary cycles.

Unit-IV

Diversity of Ecosystems, Biomes and Phytogeography: major terrestrial biomes: tundra, temperate and tropical. Principles of phytogeography; endemism; hotspots; phytogeographical divisions of India: Vegetation of Gwalior. Conservation of natural resources forests and biodiversity.

References:

1. Singh, J.S. singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi
2. Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach. Oxford.
3. Daubenmier, R.F. (1970). Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited
4. Daubenmier, R.F. (1970). Plants Communities, Willey Eaastern Private Limited
5. Odum, E. (2008) Ecology. Oxford and IBH Publisher.

Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.

APPLIED ZOOLOGY

Course Code: BSC 602 **Credit Units: 04**

Course Objectives:

The course is unique in highlighting the commercial and industrial significance/value of animals. It discusses the techniques/ methods of rearing of animals for commercial usage and the prerequisites for their successful maintenance and sustenance. The students will also study the basic toxicokinetic principles and metabolic systems to elucidate mechanisms of toxicity induced by xenobiotic compounds. To provide a strong foundation and motivation for applying fundamental concepts of Zoology in basic research to meet global challenges.

Learning Outcomes:

After Successful completion of the course graduates will be able to:

1. Employ scientific methodologies to understand and apply relevant scientific principles.
2. Understand the culture techniques of prawn, pearl and fish.
3. Understand silkworms & lac rearing and their products.
4. Understand the Bee keeping and Apiary management.
5. Understand the process of preparation of buffer, fixatives, stains and reagent.
6. Learn the techniques of Microtomy, chromatography and taxidermy.

Unit : I Aqua culture :

1. Definition, scope and significance of aquaculture.
2. Prawn Culture.
3. Pearl Culture.
4. Edible Oyster Culture.
5. Frog Culture

Unit : II Pisciculture

1. General account of freshwater edible fishes.
2. Carp culture.
3. Maintenance of aquarium.
4. Plankton and their role in fisheries.
5. Elementary knowledge of poly-culture.

Economic Entomology

General account of :-

1. Sericulture.
2. Apiculrture.
3. Lac Culture.
4. Common pests of oil seeds, vegetables and stored grains.
5. Biological control of insect-pests.

Unit IV Toxicology

1. Toxicology : Basic concept.
2. Toxicity testing LC50, LD50 acute and chronic toxicity.
3. Heavy metal toxicity (mercury, cadmium and lead).
4. Pesticides and their toxicological effects.
5. Occupational health hazards and their control.

Unit : V Lab techniques

1. Study of pH meter and chromatography.
2. Microtomy.
3. Preparation of fixatives, stains and regents.
4. Museum keeping - preservation and skeleton prepartion, taxidermy.

CHEMISTRY - VI

Course Code: BSC 603 **Credit Units: 04**

Course Objective:

The students will learn about the various laws and conditions related to electromagnetic spectrum, polymer, heterocyclic compounds, bimolecules and their derivatives.

Course Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic bonding mechanism and the application to materials in different field.
- To understand the spectroscopic concept like NMR, IR, UV, Photochemistry
- To understand polymer synthesis, properties and application in various field
- To understand synthesis and applications of carbohydrates, fatty acids & oils
- To understand synthesis and applications of amino acids, peptides, proteins

Physical Chemistry
Module I: Spectroscopy & Photochemistry
Spectroscopy
Introduction: electromagnetic radiation, regions of the spectrum, basis features of different spectrometers, statement of the Born-Oppenheimer approximation, degree of freedom.
Spectroscopy
Nuclear magnetic resonance (NMR) spectroscopy.
Proton magnetic resonance (1H NMR) spectroscopy, nuclear shielding; and Deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol. acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.
Photochemistry
Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus - Draper law, Stark-Dinstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions energy transfer processes (simple examples.)
Organic Chemistry
Module II Synthetic Polymers
Addition or chin-growth polymerization. Free radial vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.
Module III. Heterocyclic Compounds
Introduction: Molecular orbital picture and aromatic character of pyrrole, furan, thiophene and pyridine. Methods is synthesis and chemical reactions with emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.
Introduction to condensed five and six -membered heterocycles. Preparation and reactions of indole, quinoline an isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler - Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.
Module IV: Carbohydrates, Fats, Oils, Detergents & Synthetic Dyes
Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chin lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esteres. Determination of ring size of monosaccharides. Cyclic structure of D(+)- glucose. Mechanism of mutarotation.
Stuructures of ribose and deoxyribose.
An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch nad cellulose) without involving structure determination.
Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, idoine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates.
Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alzarin and Indigo.
Module V: Amino Acids, Peptides, Proteins and Nucleic Acids
Classification, Structure and stereochemistry of amino acids, Acid -Base behaviour isoelectric point and electrophoresis. Preparation and reactions of a-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structure of peptides and proteins, levels of protein structure. Protein denaturation/renaturation.
Nucleic acids: Introduction, Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.
The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

PLANT ECOLOGY & APPLIED ZOOLOGY LAB

Course Code: BSC 620 **Credit Units: 02**

Plant Ecology:

1. Analysis of soil: pH and organic matter.
2. Study of the water holding capacity and texture of soil.
3. Analysis of water: Turbidity, conductivity and Dissolved Oxygen.
4. Study of vegetation by quadrat method.
5. Determination of Frequency, density and abundance of plant species
6. Study of the biodiversity, biodiversity hotspots, Vegetation of Gwalior region

Applied Zoology:

1. Morphological characterization of common fish species.
2. Identification of two major carps – Labeo rohita and Catla catla and their life cycles.
3. Mounting of the sting apparatus.
4. Worker honey bee with emphasis on leg modifications (through specimens/charts) and whole mount preparation of the 3 pairs of legs.
5. Life cycle of mulberry silkworm, Bombyx mori (model/chart/specimens)
6. Insect collection and preservation for systematic studies.
7. Separation of amino acids/dyes/sugar by paper chromatography
8. Preparation of buffer solutions of defined ionic concentration and determination of pH
9. Microtomy of animal materials (tissue fixation, processing, paraffin block preparation, sectioning, staining and mounting)

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - VI

Course Code: BSC 621 **Credit Units: 02**

Course Contents:

ORGANIC CHEMISTRY

Module I
Laboratory Techniques
Steam Distillation
Naphthalene from its suspension in water
Clove oil from cloves
Separation of -and p-nitrophenols
Column chromatography
Separation of fluorescein and methylene blue
Separation of leaf pigments from spinach leaves
Resolution of racemic mixture of (+) mandelic acid
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PHYSICAL CHEMISTRY
Module II
Electrochemistry
(a) To determine the strength of the given conductometrically using standard alkali solution.
(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
(c) To study the saponification of ethyl acetate conductometrically.
(d) To determine the ionisation constant of a weak acid conductometrically.
(e) To titrate potentiometrically the given ferrous ammonium sulphate solution using KMnO4/ K2Cr2O7 as titrant and calculate the redox potential of Fe+++ system on the hydrogen scale.
Refractometry, Polarimetry
(a) To verify law of refraction of mixture (e.g. of glycerol and water) using Abbe's refractometer.
(b) To determine the specific rotation of a given optically active compound.
Molecular Weight Determination
(a) Determination of molecular weight of a non-volatile solute by Rest method/ Beckmann freezing point method.
(b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.
Colorimetry
To very Beer-Lambert law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: **BCU 641** **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BSC 660 **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

➢ Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

➢ Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➢ Review of Literature and Definition of Problem

➢ Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Bachelor of Technology (Biotechnology)

Programme Code: BTB

Duration – 4 Years Full Time

Programme Structure

And
Curriculum & Scheme of Examination

Batch: 2021 – 2025

AMITY UNIVERSITY
MAHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2021

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
BTB 101	Applied Mathematics – I	3	1	-	4	
CHE 101	Applied Chemistry	3	1	-	4	
CSE 104	Programming for Problem Solving	2	1	-	3	
BTB 105	Life Sciences-I	2	1	-	3	
CHE 121	Applied Chemistry Lab	-	-	2	1	
CSE 124	Programming for Problem Solving Lab	-	-	4	2	
BTB 123	Engineering Graphics Lab	-	-	2	1	
EVS 142	Environmental Studies – I	2	-	-	2	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 141	Communication Skill – I	30	-	-		
BSU 143	Behavioural Science – I	30	-	-		
 FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses:						
BTB 201	Applied Mathematics – II	3	1	-	4	
PHY 101	Applied Physics – I	3	1	-	4	
CSE 204	Object Oriented Programming Using C++	2	1	-	3	
ECE 101	Basic Electrical Engineering	3	-	-	3	
BTB 206	Life Science-II	3	-	-	3	
PHY 121	Applied Physics Lab – I	-	-	2	1	
CSE 224	Object Oriented Programming Using C++ Lab	-	-	2	1	
ECE 121	Basic Electrical Engineering Lab	-	-	2	1	
EVS 242	Environmental Studies – II	2			2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 241	Communication Skill – II	30	-	-		
BSU 243	Behavioural Science – II	30	-	-		
 FLU 244 FLU 245 FLU 246 FLU 247 FLU 248	Foreign Language – II French - II German Spanish Japanese Chinese	30	-	-		

THIRD SEMESTER

Compulsory Courses:						
BTB301	Cell Biology	3	-	-	3	
BTB302	Biochemistry - I	3	-	-	3	
BTB303	Microbiology	3	1	-	4	
BTB304	Molecular Biology	3	1	-	4	
CSE 202	Data StructuresThrough C++	3	-	-	3	
BTB320	Cell Biology Lab	-	-	2	1	
BTB321	Biochemistry Lab - I	-	-	2	1	
BTB322	Microbiology Lab	-	-	2	1	
BTB323	Molecular Biology Lab	-	-	2	1	
CSE 222	Data Structures Through C++ Lab	-	-	2	1	
BTB330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU341	Communication Skill - III	30	-	-		
BSU 343	Behavioural Science - III	30	-	-		
	Foreign Language - III	30	-	-		
FLU 344	French - III					
FLU 345	German					
FLU 346	Spanish					
FLU 347	Japanese					
FLU 348	Chinese					

TERM PAPER DURING SUMMER BREAK

FOURTH SEMESTER

Compulsory Courses:						
BTB401	Biochemistry – II	3	1	-	4	
BTB402	Genetics	3	1	-	4	
BTB403	Methods & Instrumentation in Biotechnology	3	-	-	3	
BTB404	Chemical Biology	2	1	-	3	
CSE 403	Java Programming **(V to IV)**	3	-	-	3	
BTB420	Biochemistry Lab - II	-	-	2	1	
BTB421	Genetics Lab	-	-	2	1	
BTB422	Methods & Instrumentation in Biotechnology Lab	-	-	2	1	
CSE 423	Java Programming Lab **(V to IV)**	-	-	4	2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 441	Communication Skill - IV	30	-	-		
BSU 443	Behavioural Science - IV	30	-	-		
	Foreign Language - IV	30	-	-		
FLU 444	French - IV					
FLU 445	German					
FLU 446	Spanish					
FLU 447	Japanese					
FLU 448	Chinese					

SUMMER PROJECT I – (6 - 8 WEEKS)

FIFTH SEMESTER

Compulsory Courses:						
BTB501	Plant Biotechnology	3	-	-	3	
BTB502	Animal Biotechnology	3	-	-	3	
BTB503	Structural Biology	3	-	-	3	
BTB504	Chemical Engineering Principles	3	-	-	3	
BTB505	Basic Bioanalytical Techniques	3	-	-	3	
CSE510	Advanced Programmimg through Python **(New)**	3	-	-	3	
BTB520	Plant Biotechnology Lab	-	-	2	1	
BTB521	Animal Biotechnology Lab	-	-	2	1	
BTB522	Structural Biology Lab	-	-	2	1	
CSE530	Advanced Programmimg through Python Lab **(New)**	-	-	2	1	
BTB560	Summer Project – I (Evaluation)	-	-	-	5	
	TOTAL				**27**	
Optional Courses - Value Added Courses; Any Three:		**Hrs/Semester**				
BCU 541	Communication Skill – V	30	-	-		
BSU 543	Behavioural Science – V	30	-	-		
	Foreign Language – V	30	-	-		
FLU 544	French - V					
FLU 545	German					
FLU 546	Spanish					
FLU 547	Japanese					
FLU 548	Chinese					

SIXTH SEMESTER

Compulsory Courses:						
BTB601	Recombinant DNA Technology	3	-	-	3	
BTB602	Enzymology & Enzyme Technology	3	-	-	3	
BTB603	Immunology & Immunotechnology	3	1	-	4	
BTB604	Computational Biology	3	-	-	3	
BTB605	Fundamentals of Biochemical Engineering	3	-	-	3	
BTB620	Recombinant DNA Technology Lab	-	-	2	1	
BTB621	Enzymology & Enzyme Technology Lab	-	-	2	1	
BTB622	Immunology & Immunotechnolgy Lab	-	-	2	1	
BTB623	Computational Biology Lab	-	-	2	1	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three:		**Hrs/Semester**				
BCU 641	Communication Skill – VI	30	-	-		
BSU 643	Behavioural Science – VI	30	-	-		
	Foreign Language -VI	30	-	-		
FLU 644	French - VI					
FLU 645	German					
FLU 646	Spanish					
FLU 647	Japanese					
FLU 648	Chinese					

SUMMER PROJECT - II – (6 - 8 WEEKS)

SEVENTH SEMESTER

Compulsory Courses:						
BTB701	Bioprocess Technology	3	-	-	3	
BTB702	Downstream Processing	3	-	-	3	
BTB703	Statistics for Biology	3	-	-	3	
 BTB704 BTB705 BTB706 BTB707 BTB708 BTB709 BTB710	**Elective (Anyone of the following 8)** • Biosensors • Thermodynamics of Biological Systems • Pharmaceutical Chemistry & Drug Design • Current Topics in Biotechnology • Environmental Biotechnology • Bioprocess Plant Design • Artificial Neural Networks	3	-	-	3	
CSE 710	Relational Database Management System **(New)**	3	-	-	3	
BTB720	Bioprocess Technology Lab	-	-	2	1	
BTB721	Downstream Processing Lab	-	-	2	1	
CSE 730	Relational Database Management System Lab **(New)**	-	-	2	1	
BTB760	Summer Project - II (Evaluation)	-	-	-	6	
	TOTAL				**24**	

EIGHTH SEMESTER

Compulsory Courses:						
BTB801	Genomic & Proteomics	3	1	-	4	
BTB802	Drug Delivery Systems	3	-	-	3	
BCH 621	Management, Accounting & Cost Control	1	-	-	1	
BCH 622	Project Management	1	-	-	1	
BCH 623	Principles of Management & Enterprenurship Development	1	-	-	1	
CSE 804	ASP.NET	3	-	-	3	
BTB820	Genomic & Proteomics Lab	-	-	2	1	
CSE 824	ASP.NET	-	-	2	1	
BTB860	Major Project (10-12 Weeks)	-	-	-	16	
	TOTAL				**31**	

APPLIED MATHEMATICS – I

Course Code: BTB 101 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in differen disciplines.

Course Contents:

Module I: Differential Calculus

Derivative of a function, Derivatives at a point, Fundamental rules for differentiation: Product Rule, Quotient Rule and Chain Rule, Differentiation of Implicit Functions, Parametric forms and Logarithmic Differentiation, Successive differentiation, Leibnitz's theorem (without proof), Mean value theorem, Taylor's and Maclaurin's Theorem, Asymptote & Curvature, Partial Differentiation, Euler's Theorem, Maxima and Minima

Module II: Integral Calculus

Fundamental Integral Formulae, Methods of Integration: Integration by Substitution, By Parts, Partial Fractions, Definite Integral and its Properties, Reduction Formulae, Application to length, Area and Volume.

Module III: Ordinary Differential Equations

Definition of Order and Degree of differential equation, Formation of ODEs, Solution of Differential Equation of 1st Order and 1st Degree: Variable Separation, Homogeneous Differential Equations, Linear Differential Equations, Exact Differential Equations, General Linear ODE of Second Order, Solution of Homogeneous Equation, Solution of Simple Simultaneous ODE

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Differential Calculus by Shanti Narain
- Integral Calculus by Shanti Narain

References:

- Differential Equation by A.R.Forsyth
- Higher Engineering Mathematics by H.K. Dass

APPLIED CHEMISTRY

Course Code: CHE 101 Credit Units: 04

Course Objective:

Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields. The makeup of substances is always a key factor, which must be known. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials. To train students practically in basic and applied principles of Chemistry.

Module I: Chemical Bonding & Chemical Equilibrium (4hours)

Types of bond: Ionic, Covalent and Co-ordinate bond. Fajan's rule; Hybridisation. H- bonding. Valence bond and Molecular orbital theory for diatomic molecule.

Le Chatelier's Principle; Equilibrium constant from Thermodynamic Constants; Acid-Base Concept; Weak acid and Weak base and their salts; Solubility Product; pH and pOH, Buffer Solution, Buffer Action.

Module II: Thermodynamics (Use of free energy in chemical equilibria) (6 hours)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Module III: Stereochemistry, Organic reactions & mechanism (10 hours)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Electronegativity and dipole moment. Electron Displacement Effects: Inductive Effect; Mesomeric Effect; Electromeric Effects. Fission of covalent bonds. Intermediates of Organic reactions; Carbonium , Carbanion, Free Radical and Carbene.

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings.

Module IV: Polymers(6 hours)

Introduction; Polymerization; Addition and Condensation Polymerization. Thermosetting and Thermoplastic Polymers. Molecular Weight of Polymer; Rubber, Plastic and Fiber; Preparation.

Properties and uses of PMMA, Polyester, Epoxy Resins and Bakelite, Silicone Polymers.

Module V: Water Technology (6 hours)

Introduction and specifications of water, Hardness and its determination (EDTA method only), Alkalinity, Boiler feed water, boiler problems; scale, sludge, priming & foaming: causes & prevention, caustic embrittlement & corrosion; causes & prevention, Carbonate & phosphate conditioning, colloidal conditioning & calgon treatment, Water softening processes; Lime – soda process, Ion exchange method.

Water for domestic use.

Module VI: Instrumental Methods of analysis (8 hours)

Introduction; Principles of spectroscopy; Laws of absorbance,

IR: Principle, Instrumentation, Application

UV : Principle, Instrumentation, Application

NMR : Principle, Instrumentation, Application

Course Outcomes:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. To understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test, S/V/Q/HA - Seminar/Viva/Quiz/Home Assignment, ESE - End Semester Examination.

Text & References:

i. Physical Chemistry, by P. W. Atkins
ii. Engineering Chemistry , by Dr. Sunita Rattan
iii. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
iv. Organic Spectroscopy, by Jagmohan
v. Engineering Chemistry by Jain & Jain
vi. University chemistry, by B. H. Maha
vii. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore.

PROGRAMMING FOR PROBLEM SOLVING

Course Code: CSE 104 **Credit Units: 03**

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Module 1: Introduction to Programming (3 hours)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Module 2: Programming Essential (8 hours)

Arithmetic expressions and precedence, Conditional Branching and Loop, Writing and evaluation of conditionals and consequent branching , Iteration and loops.

Module 3: Arrays (4 hours)

Arrays (1-D, 2-D), Character arrays and Strings.

Module 4: Basic Algorithms (3 hours)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 5: Function (3 hours)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Module 6: Recursion (3 hours)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module 7: Structure (2 hours)

Structures, Defining structures and Array of Structures.

Module8: Pointers (2 hours)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Module 9: File handling(2 hours)

Basics of file Handling.

Course Outcomes:

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical error
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, EE: End Semester Examination;

Text & References:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

LIFE SCIENCES-I

Course Code: BTB 105 **Credit Units: 03**

Course Objective:

The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata and classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Learning outcome:

After successful completion of the course student will be able to:

- Learn about basics of animal and plant kingdom.
- Learn about taxonomy and variability among different groups.
- Enhance collaborative and research outlook.
- Develops awareness for career options in biological sciences.

Course Contents:

Module I: Invertebrates

Saileats features and outline classification of various phyla of invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II: Vertebrates

Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module-III: Lower Plants

Systematic: Recent trends in classification of Algae, Fungi, Bryophyte and Pteridophytes.
General account: Characteristic features; mode of reproduction and life cycles in Algae; Fungi including Lichens and Mycorrhiza; Bryophyte and Pteridophytes.
Economic Importance: Industrial applications; Ecological significance; Importance in agriculture.

Module-IV: Higher Plants

Systematics: Elementary knowledge of ICBN: Principles; Rank of taxa, Retention and rejection of names; Type method; Principle of priority; Effective and valid publication; Author Citation. Broad outline of Bentham & Hooker, D.D Pant's classification
General account: General characteristic features, Distribution, mode of reproduction and generalised life cycles of Gymnosperms and Angiosperms.
Economic Importance: Industrial and ecological importance of Gymnosperms and Angiosperms

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Fundamentals of Environmental Chemistry, G.S.Sodhi, Narosa Publishers.
- Introduction to Environmental Pollution, B.K Sharma, H.Kaur, Goel Publishers.
- Biochemistry Styrier.
- Cell Biology, C B Pawar.
- Biochemistry, Lalinger.
- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande & D.K. Jain, Rastogi Publication.
- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.

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APPLIED CHEMISTRY LAB

Course Code: CHE 121 **Credits: 01**
Hours: 20

Course Objective:

Principles of chemistry relevant to the study of science and engineering have clarity of understanding through experiments. Learning process and learning outcomes get enhanced through experiments relevant to and commensurate with theoretical knowledge. The lab course is designed to teach the students the basiucs and advanced chemical principles through experiments.
Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic application of principles.

Course Contents:

List of experiments: [Any 10]

1. Chemical analysis of water for determination of hardness. (2 Hrs)
2. Chemical analysis of water for determination of Alkalinity.(2 Hrs)
3. Chemical analysis of water for determination of residual Chlorine.(2 Hrs)
4. Synthesis of urea - formaldehyde resin.(2 Hrs)
5. Determination of dissolved oxygen in water.(2 Hrs)
6. Determination of surface tension of a given liquid.(2 Hrs)
7. Plant pigments separation by paper chromatography.(2 Hrs)
8. Conductometric titration.(2 Hrs)
9. Determination of water modules of crystallization in Mohr's salt.(2 Hrs)
10. Application of distribution law in the determination of equilibrium constant.(2 Hrs)
11. Determination of amount of Oxalic acid and Sulphuric acid in one litre of solution.(2 Hrs)
12. pH metric titration.(2 Hrs)

Laboratory Outcome:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**EE**
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: CSE 124 **Credit Units: 02**
Total Hours :40

Course Objective:

Thepurposeofthiscourseistointroducetostudents to the field of programming using C language. Thestudentswillbeabletoenhancethereanalyzingandproblemsolvingskillsanduse thesameforwritingprogramsinC.

List of experiments/demonstrations:
Tutorial 1: Problem solving using computers:**(2 hours)**
Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions:**(2 hours)**
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions:**(4 hours)**
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops:**(4 hours)**
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting**: (4 hours)**
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings**: (4 hours)**
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value: **(4 hours)**
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):**(4 hours)**
Lab 8 and 9: Programming for solving Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls:**(4 hours)**
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation: **(4 hours)**
Lab 11: Pointers and structures
Tutorial 12: File handling:**(4 hours)**
Lab 12: File operations

Course Outcomes:

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –Internal Assessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

ENGINEERING GRAPHICS LAB

Course Code:BTB 123 **Credit Units: 01**

Course Objective:

This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General

Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines

Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes

Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures

Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids

Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI:Development of Surface

Development of simple objects with and without sectioning. Isometric Projection

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

- M.B. Shah & B.C. Rana, Engineering Drawing, Pearson Education, 2007
- PS Gill, Engineering Drawing, Kataria Publication
- ND Bhatt, Engineering Drawing, Charotar publications
- N Sidheshwar, Engineering Drawing, Tata McGraw Hill
- CL tanta, Mechanical Drawing, “Dhanpat Rai”

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha, Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.

- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

This course aims at imparting an understanding of:

- Understanding self & process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and its effective on personality
- Building Emotional Competency

Course Contents:

Module I: Self: Core Competency **(2 Hours)**

- Understanding of Self
- Components of Self – Self identity
- Self concept
- Self confidence
- Self image

Module II: Techniques of Self Awareness **(2 Hours)**

- Exploration through Johari Window
- Mapping the key characteristics of self
- Framing a charter for self
- Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness **(2 Hours)**

- Meaning
- Importance
- Components of self esteem
- High and low self esteem
- Measuring your self esteem

Module IV: Building Positive Attitude **(2 Hours)**

- Meaning and nature of attitude
- Components and Types of attitude
- Importance and relevance of attitude

Module V: Building Emotional Competence **(2 Hours)**

- Emotional Intelligence – Meaning, components, Importance and Relevance
- Positive and negative emotions
- Healthy and Unhealthy expression of emotions

Student learning outcomes

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-I

CourseCode: FLU144 **Creditunits: 02**

CourseObjective:
Tofamiliarize studentswiththeFrenchlanguage,withitsphonetic systemanditsaccents.
Toenable students
- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone’sfamily,tastes andpreferences

CourseContents:
Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:
S’adresserpolimentàquelqu’un,entrerencontact,seprésenter,présenterquelqu’un,saluer,poserdesquestions
simplespourconnaître quelqu’un,épeleret compter
Dossier2:EnfamilleActesdeCommunication:
Parler de sa famille, Décrire quelqu’un, exprimer ses goûts, écrire et comprendre un message court, inviter
quelqu’un,exprimerla possession,la négation
Grammaire :
1. articles indéfinis,articlesdéfinis, masculinetféminindesnomset desadjectifs,pluriel desnomset desadjectifs
2. pronomssujetsettoniques,on,c’est/il est+ profession,
3.masculinet fémininдesadjectifsdenationalité
4. verbes-être,avoir,aller,‘er’groupe
5. l’interrogation–l’intonation,est-ce que,quiest-ce ? Qu’est-ce que? L’inversion; où,comment,quand; quel
6. la négation
7. adjectifspossessifs

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
· Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
· Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.
Références:
· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

APPLIED MATHEMATICS – II

Course Code: BTB 201 **Credit Units: 04**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from athematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

Module I: Linear Algebra

Definition of a Matrix, Operations on Matrices Determinants, Elementary Operations, Reduction of a Matrix to Row Echelon Form, Rank of a Matrix, Consistency of Linear Simultaneous Equations, Gauss Elimination and Gauss Jordan –Method, Eigen values and Eigen Vectors of Matrix, Caley-Hamilton theorem, Diagonalization of a matrix.

Module II: Complex Number

Definition of Complex Number, Equality, Conjugate and Modulus of a Complex Number, Polar form of a Complex Number, De-Moivre's Theorem, Roots of a Complex Number, Exponential and Circular function of a Complex Number, Hyperbolic Functions and their inverses.

Module III: Vector Calculus

Scalar and vector field, Gradient, Divergence and Curl, Directional Derivative, Evaluation of a Line Integral, Green's theorem in plain (without proof), Stoke's theorem (without proof) and Gauss Divergence theorem (without proof)

Module IV: Probability and Statistics

Frequency Distribution, Arithmetic Mean, Median, Partition Values, Mode, Variance and Standard Deviation, Curve Fitting, Principle of least squares, Linear regression.

Introduction to Probability, Addition and Multiplication theorem of Probability, Random variables and Probability Distribution,Expected values, Binomial distribution, Poisson distribution and Normal.

Distribution and their Applications.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Higher Engineering Mathematics by H.K. Dass

APPLIED PHYSICS - I

Course Code: PHY-101 **Credit Units: 04**
Credit hours: 40hrs.

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I: Electromagnetics (10hrs)

Scalar and vector fields, gradient of a scalar field, physical significance of gradient, equipotential surface. Line, surface and volume integrals, Divergence and curl of vector field and mathematical analysis physical significance, Electric flux, Gauss' law, Proof and Applications, Gauss divergence and Stokes theorems.

Differential form of Gauss' Law, Amperes' Law, Displacement current, Faradays Law, Maxwell equations in free space & isotropic media (Integral form & differential form), EM wave propagation in free space, Poynting vector.

Module II: Special Theory of Relativity (10hrs)

Michelson-Morley experiment, Importance of negative result, Inertial & non-inertial frames of reference, Einstein's postulates of Special theory of Relativity, Space-time coordinate system, Relativistic Space Time transformation (Lorentz transformation equation), Transformation of velocity, Addition of velocities, Length contraction and Time dilation, Mass-energy equivalence (Einstein's energy mass relation) & Derivation of Variation of mass with velocity,

Module III: Wave Mechanics (10hrs)

Wave particle duality, De-Broglie matter waves, phase and group velocity, Heisenberg uncertainty principle, wave function and its physical interpretation, Operators, expectation values. Time dependent & time independent Schrödinger wave equation for free & bound states, square well potential (rigid wall), Step potential.

Module IV : Semiconductor and Electronic Materials (10hrs)

Band Theory of Solids, Semi-conductors: Intrinsic and Extrinsic, Carreir concentration, Direct and indirect band-gaps, Types of Electronic materials, p-n Junction Diode,Diode Equation, Breakdown in p-n Junction Diode: Avalanche and Zener, Zener Diode and its applications photoconductivity and photovoltaics.

Superconductivity, Meissner Effect, Type I and Type II Superconductors

Course Outcomes:

After successful completion of the course students will have the knowledge and skill to:

- Apply vector calculus to static electric-magnetic fields in different engineering situations.
- Analyze andApply Maxwell's equation to diverse engineering problems.
- Relate semiconductor material properties to semiconductor devices.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q**	**HA**	**EE**
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- Physics of waves, W. C. Elmore & M. A. Heald
- Introduction to Electrodynamics, D. J. Griffith
- Engineering Physics, Satya Prakash
- Concept of Modern Physics, A. Beiser
- Solid State Physics, S. O. P.

OBJECT ORIENTED PROGRAMMING USING C++

Course Code: CSE 204 **CreditUnits: 03**
Total Hours: 30

Course Objective:

The objective of this module is to introduce object oriented programming. To explore and implement the various features of OOP such as inheritance, polymorphism, Exceptional handling using programming language C++. After completing this course student can easily identify the basic difference between the programming approaches like procedural and object oriented.

Module I: Introduction (6 hours)
Review of C, Difference between C and C++, Procedure Oriented and Object Oriented Approach. Basic Concepts:Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing. Characteristics of Object-Oriented Languages. Introduction to Object-Oriented Modeling techniques (Object, Functional and Dynamic Modeling).

Module 2: Classes and Objects (7 hours)
Abstract data types, Object & classes, attributes, methods, C++ class declaration, Local Class and Global Class, State identity and behaviour of an object, Local Object and Global Object, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators.

Module 3: Inheritance (6 hours)
Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hierarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes.

Module 4: Polymorphism (6 hours)
Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary) Polymorphism by parameter, Pointer to objects, this pointer, Virtual Functions, pure virtual functions.

Module 5: Strings, Files and Exception Handling (5 hours)
Manipulating strings, Streams and files handling, formatted and Unformatted Input output. Exception handling, Generic Programming – function template, class Template Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators.

Examination Scheme:

Components	A	CT	S/V/Q/HA	EE
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Course Outcomes:

At the end of this course, students will demonstrate ability to:

- To apply concepts of classes and objects in real world scenarios.
- Understand object-oriented programming features in C++,
- Apply these features to program design and implementation,
- Understand object-oriented concepts and how they are supported by C++,
- Gain some practical experience of C++.

Text & References:

Text:
• A.R.Venugopal, Rajkumar, T. Ravishanker “Mastering C++”, TMH, 1997
• R. Lafore, “Object Oriented Programming using C++”, BPB Publications, 2004.
• “Object Oriented Programming with C++” By E. Balagurusamy.
• Schildt Herbert, “C++: The Complete Reference”, Wiley DreamTech, 2005.
References:
• Parasons, “Object Oriented Programming with C++”, BPB Publication, 1999.
• Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication, 2002.
• Yashwant Kanethkar, “Object Oriented Programming using C++”, BPB, 2004

BASIC ELECTRICAL ENGINEERING

Course Code: ECE - 101 **Credit Units: 03**

Course Objective: The objective of the course is to provide a brief knowledge of Electrical Engineering to students of all disciplines. This Course includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of Transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Module 1:
DC Circuits (7 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's and Norton's Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2:
AC Circuits (7 hours) Representation of sinusoidal waveforms, peak and R.M.S. values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3:
Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4:
Electrical Machines (6 hours) Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5:
Power Converters (4 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Course Outcomes: •
To understand and analyze basic electric and magnetic circuits. • To study the working principles of electrical machines and power converters. • To introduce the components of low voltage electrical installations.

Examination Scheme:
Components A CT S/V/Q/HA EE Weightage (%) 5 15 10 70 CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Text & References:

• D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering" , Tata McGraw Hill, 2010.
• D. C. Kulshreshtha, " Basic Electrical Engineering", McGraw Hill, 2009.
• L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
• E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
• V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

LIFE SCIENCES - II

Course Code: BTB 206 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. Moreover paper will provide knowledge of various physiological activities of higher plants which will help them to understand the various profiles of modern biotechnology.

BTB 206: LIFE SCIENCES- II

Learning outcome:

After successful completion of the course student will be able to:

- Develops knowledge of animal and plant physiological aspects.
- Deals with functioning of systems in both animals and plants.
- Acts as useful tool for further research and innovation.
- Develops collaborative and innovative approach.
- Creates verbal and written communication skills in subject.

Course Contents:

Module I: Anatomy & Physiology of Rabbit.

- Integumentary system
- Skeletal System: Girdles only
- Digestive system
- Respiratory System

Module II: Anatomy & Physiology of Rabbit.

- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Endocrine System
- Urinogenital System

Module-III Plant Physiology-I

Plant-water Relations: Importance of water to plant life; physical properties of water; Imbibition, Diffusion, Osmosis and Plasmolysis; absorption and transport of water; transpiration-types, physiology of stomata, factors affecting transpiration, importance of transpiration.

Transport of Organic Substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation; Plant Hormones.

Module-IV Plant Physiology-II

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photo-phosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

Respiration: Seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; physiology of senescence; fruit ripening.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York

  Shier, D., Butler, J. and Lewis, R., Hole"s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.
- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.

  Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing Hours.

APPLIED PHYSICS LAB - I

Course Code: PHY121 **Credit Units: 01**
CreditHours:20hrs.

Course Objective
To provide detailed introduction to the principal class of semiconductor andelectronics components
Time allocated for experiments No.1-10 is 2 hours each.

List of Experiments:

1. To determine the forbidden band gap energy of a semiconductor.
2. To determine the frequency of AC mains using sonometer.
3. To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
4. To study the common base characteristics of a PNP junction transistor, by drawinginput characteristic curves andoutput characteristic curves.
5. To study the common emitter characteristics of a NPN junction transistor, by drawinginput characteristic curves andoutput characteristic curves.
6. To study a series /parallel resonant LCR circuit, its resonate frequency and quality factor
7. To study the voltage regulation characteristics of a zener diode.
8. To study the characteristics of a solar cell.
9. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
10. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.

Course Outcomes: After completion of course student will develop: Practical understanding andapplications of fundamental concept of classical and modern Physics.
Examination Scheme:

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**EE**
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

OBJECT ORIENTED PROGRAMMING USING C++ LAB

Course Code: CSE 224 **Credit Units: 01**
Total Hours: 20

Course Objective:

To perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members.
SOFTWARE REQUIRED: TURBO C++

Lab assignment will be based on the following: (20 Hours)

1. [Classes and Objects] Write a program that uses a class where the member functions are defined inside a class. **(1Hours)**
2. [Classes and Objects] Write a program that uses a class where the member functions are defined outside a class. **(1Hours)**
3. [Classes and Objects] Write a Program to Demonstrate Inline functions. **(1Hours)**
4. [Classes and Objects] Write a Program to Demonstrate Friend function, classes and this pointer. **(1Hours)**
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and parameterized constructors. **(2Hours)**
6. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement operators. **(2Hours)**
7. [Inheritance] Write a program to demonstrate the single inheritance. **(1Hours)**
8. [Inheritance] Write a program to demonstrate the multiple inheritance. **(1Hours)**
9. [Inheritance] Write a Program to demonstrate use of protected members, public & private protected classes, multilevel inheritance etc. **(1Hours)**
10. [Polymorphism] Write a program to demonstrate the runtime polymorphism. **(1Hours)**
11. [Exception Handling] Write a program to demonstrate the exception handling. **(2Hours)**
12. [Templates and Generic Programming] Write a program to demonstrate the use of function template. **(2Hours)**
13. [Templates and Generic Programming] Write a program to demonstrate the use of class template. **(2Hours)**
14. [File Handling] Write a Program to Show how file management is done in C++. **(2Hours)**

Examination Scheme:

IA			**EE**			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**Practical Record**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

Course Outcome:

At the end of this course, students will demonstrate ability to:

- knowledge of the structure and model of the C++ programming language, (knowledge)
- evaluate user requirements for software functionality required to decide whether the C++ programming language can meet user requirements (analysis)
- design the object-oriented programs for real world problems.

Text & References:

Text:
• A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997
• R. Lafore, "Object Oriented Programming using C++", BPB Publications, 2004.
• "Object Oriented Programming with C++" By E. Balagurusamy.
• Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.
References:
• Parasons, "Object Oriented Programming with C++", BPB Publication, 1999.
• Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication, 2002.
• Yashwant Kanethkar, "Object Oriented Programming using C++", BPB, 2004.

BASIC ELECTRICAL ENGINEERING LAB

Course Code: ECE 121 **Credit Units: 01**

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. To verify KVL & KCL in the given network.
3. To verify Superposition Theorem.
4. To verify Maximum Power Transfer Theorem.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. To determine and verify RTh, VTh, RN, IN in a given network.
8. To perform open circuit & short circuit test on a single-phase transformer.
9. To study transient response of a given RLC Circuit
10. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT Switchgear.

Laboratory Outcomes:

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

Examination Scheme:

IA			**EE**			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

<table>
<tr><td colspan="3">Course Contents / Syllabus:</td></tr>
<tr><td>1.</td><td>Module I Communication</td><td>35% Weightage</td></tr>
<tr><td></td><td>• Process and Importance
• Models of Communication (Linear & Shannon Weaver)
• Role and Purpose
• Types & Channels
• Communication Networks
• Principles & Barriers</td><td></td></tr>
<tr><td>2.</td><td>Module II Verbal Communication</td><td>25% Weightage</td></tr>
<tr><td></td><td>Oral Communication: Forms, Advantages & Disadvantages
Written Communication: Forms, Advantages & Disadvantages
Introduction of Communication Skills (Listening, Speaking, Reading, Writing)</td><td></td></tr>
<tr><td>3.</td><td>Module III Non-Verbal Communication</td><td>30% Weightage</td></tr>
<tr><td></td><td>• Principles & Significance of Nonverbal Communication
• KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics)
• Visible Code</td><td></td></tr>
<tr><td>4.</td><td>Module IV : Prose</td><td>10% Weightage</td></tr>
<tr><td></td><td>TEXT: APJ Abdul Kalam and Arun Tiwari. Wings of Fire: An Autobiography, Universities Press, 2011
Comprehension Questions will be set in the End-Semester Exam</td><td></td></tr>
<tr><td>5.</td><td>Student Learning Outcomes:
The students should be able to :
• Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment</td><td></td></tr>
<tr><td>6.</td><td colspan="2">Pedagogy for Course Delivery:
• Extempore
• Presentations
• Lectures</td></tr>
<tr><td>7.</td><td colspan="2">Assessment/ Examination Scheme:</td></tr>
</table>

Theory L/T (%)	**Lab/Practical/Studio (%)**
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examinatio**
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*

Verma, Shalini. Word Power made Handy, S. Chand Publications.

High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*

Alan Pease : Body Language

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.
Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**
Total Hours: 10

Course Objective:

This course aims at enabling students towards:

- Understand the importance of individual differences
- Better understanding of self in relation to society and nation
- Facilitation for a meaningful existence and adjustment in society
- Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

- Personality: Definition& Relevance
- Importance of nature & nurture in Personality Development
- Importance and Recognition of Individual differences in Personality
- Accepting and Managing Individual differences
- Intuition, Judgment, Perception & Sensation (MBTI)
- BIG5 Factors

Module II: Managing Diversity

- Defining Diversity
- Affirmation Action and Managing Diversity **(2 Hours)**
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

Module III: Socialization **(2 Hours)**

- Nature of Socialization
- Social Interaction
- Interaction of Socialization Process
- Contributions to Society and Nation

Module IV: Patriotism and National Pride **(2 Hours)**

- Sense of pride and patriotism
- Importance of discipline and hard work
- Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

- Meaning and Importance of human rights
- Human rights awareness
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

▪Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions
▪Student will be able to understand and respect individual difference, so to enhance the relationship ▪Learn social responsibility and develop a sense of citizenship
▪Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Atten dance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

•Davis, K. Organizational Behaviour,
•Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour
•Dressler, David and Cans, Donald: The Study of Human Interaction
.•Lapiere, Richard. T – Social Change
•Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
•Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. Robbins
O.B.Stephen;. Organizational Behaviou

Français-II

CourseCode: FLU244 **Creditunits: 02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

CourseContents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:
Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessportsetdes loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:
Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,compareret exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

CELL BIOLOGY

Course Code: BTB 301 **Credit Units: 03**

Course Objective:

Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. It incorporates elements of biology, maths, physics and chemistry with combination of computers and electronics. The object of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand and explain the cell theory origin of life, and evolution.
- Understand the cell cycle, regulatation and checkpoints' in the cell-cycle.
- Understand structure of cell membranes, transport of solutes across cell membranes.
- Learn structure and function of the cell cytoskeleton, cilia and flagella.
- Understand mechanism of signaling and receptors involved in signaling process.

Course Contents:

Module I
The cell theory, pre cellular evolution, prokaryotic and eukaryotic cells.

Module II
Cell cycle - molecular events, cell division, mitosis and meiosis.

Module III
Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus,lysosomes, peroxisomes, golgi bodies, and transport across membranes.

Module IV
Cell locomotion- cytoskeleton, structure and function of cilia and flagella.

Module V
Cellular signaling –general mechanism of signaling and structures of the various types of receptors.

Module VI
Types of cancer, etiology of cancer, metastasis, cytological role of p53 and p21 genes in cancer development.

Module VII
Apoptosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmilian
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.

BIOCHEMISTRY - I

Course Code: BTB 302 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about chemical interactions in biological system.
- Develop the understanding between structure and function of carbohydrates & lipids.
- Learn the concept of metabolism and energy involved in metabolic pathways.
- Understand the metabolic pathways and regulations of carbohydrates metabolism.
- Learn about the digestion, transport, anabolism and catabolism of lipids in the body.

Course Contents:

Module I

Introduction aims and scope

Chemical foundations of Biology -Properties of water, acids, bases and buffers, covalent bonds, Non-covalent interactions in biological systems.

Module II

Introduction to biomolecules - *Carbohydrates* -Sugars; Polysaccharides

Lipids -classification, structure and function. Lipids and biological membranes, Lipid linked proteins and lipoproteins, Atherosclerosis.

Module III

Metabolism and bioenergetics -First and second law, free energy and chemical equilibrium, Organic reaction mechanisms, Design of metabolism-concept of free energy, ATP-ADP cycle. Cellular energy transactions -role of mitochondria and chloroplast

Module IV

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondrion and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module V

Lipid metabolism -Lipid digestion, absorption and transport, fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism. Cholesterol and Arachidonic Acid metabolism, Phospholipids, Sphingolipids and Glycolipids

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

Microbiology

Course Title: Microbiology **Credit Units: 4**
Course Level: UG Level **Course Code: BTB-303**

Course Objectives:

•The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	
Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization	15%
Module II	
Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, Fed batch culture, continuous culture, culture collection and maintenance of cultures.	15%
Module III	
Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.	10%
Module IV	
Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).	15%
Module V	
Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophilesViruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.	15%
Module VI	
Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.	15%
Module VII	
Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.	15%

Student Learning Outcomes:

- Understand the microbiological techniques for the isolation and characterization of microbes.
- Understand the mechanism of different metabolic processes.
- Know the physiology and survival mechanism of extremophilic bacteria.
- Know the concept of virus lytic and lysogenic cycle is quite clear to students.
- Understand the epidemiology and microbial pathogenesis.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	10	5	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International

Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC.Brown Publisher.

MOLECULAR BIOLOGY

Course Code: BTB 304 **CreditUnits: 04**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about the mechanism of replication of DNA in prokaryotes and eukaryotes.
- Learn and compare the mechanism of transcription in prokaryotes and eukaryotes.
- Learn the various post-transcriptional processes in cell.
- Learn about the mechanism of protein synthesis in prokaryotes and eukaryotes.
- Understand about gene expression regulation and various mechanisms of gene silencing.

Course Contents:

Module I: DNA Replication and repair

Nucleic Acid Structure and Functions, Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication, DNA repair Mechanism.

Module II: Transcription

Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.

Module III: Modifications in RNA

5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

Module IV: Translation

Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.

Module V: Regulation of Gene Expression in prokaryotic and eukaryotic systems

Lac operon, Ara operan, regulation in Eukaryotes, Epigenetics.

Module VI: Antisense and Ribozyme technology

Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping, Biochemistry of Ribozyme; Hammerhead, hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense and ribozyme technologies.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing
- Gene VIII, Benjamin Lewin 2005, Oxford University Press

References:

- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.

DATA STRUCTURES THROUGH C++

Course Code: CSE 202 **CreditUnits: 03**
Total Hours : 30

Course Objectives:

To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. To understand the notations used to analyze the Performance of algorithms. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations. To choose an appropriate data structure for a specified application. To understand and analyze various searching and sorting algorithms. To learn to implement ADTs such as lists, stacks, queues, trees, graphs, search trees in C++ to solve problems.

Course Contents:

Module I: Introduction to C++ (7 Hours)
C++ Programming Concepts: Review of C, input and output in C++, functions in C++- value parameters, reference parameters, Parameter passing, function overloading, function templates, Exceptions-throwing an exception and handling an exception, arrays, pointers, new and delete operators, class and object, access specifiers , friend functions, constructors and destructor, Operator overloading, class templates, Inheritance and Polymorphism.
Basic Concepts - Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Complexity Analysis Examples, Introduction to Linear and Non Linear data structures.
Module II: Introduction to DS (6 Hours)
Representation of single, two dimensional arrays, sparse matrices-array and linked representations.
Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.
Stack ADT, definition, array and linked implementations, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition, array and linked Implementations, Circular queues-Insertion and deletion operations.
Module III: TREES (6 Hours)
Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees, Priority Queues –Definition and applications, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.
Minimum Spanning Tree: Prim's and Kruskal's Algorithm, Shortest Path Algorithms.
Module IV: SEARCHING & SORTING (5 Hours)
Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods.
Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort, Comparison of Sorting methods.
Module V: GRAPHS(6 Hours)
Graphs–Definitions, Terminology, Applications and more definitions, Properties, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis,
Search Trees-Binary Search Tree ADT, Definition, Operations- Searching, Insertion and Deletion, Balanced search trees-AVL Trees-Definition and Examples only, B-Trees- Definition and Examples only, Red-Black Trees-Definitions and Examples only, Comparison of Search Trees.
Course Outcomes:

- Ability to choose appropriate data structures to represent data items in real world problems.
- Ability to analyze the time and space complexities of algorithms.
- Ability to design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, search trees, heaps, graphs, and B-trees.
- Able to analyze and implement various kinds of searching and sorting techniques.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;
Text & References:
Text:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference:

- Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

CELL BIOLOGY LAB

Course Code: BTB 320 **Credit Units: 01**

Course Contents:

Module I
Microscopy: Light microscopy, Bright field, Phase contrast & Gram's staining.

Module II
Study of chromoplasts, chloroplast in plant cell.

Module III: Cell Division
Mitosis and Meiosis

Module IV
Study of permanent slides of types of cancer

Module V
Study of apoptosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOCHEMISTRY LAB-I

Course Title: Biochemistry Lab-I **Credit Units: 1**
Course Level: UG Level **Course Code: BTB-321**

Course Objectives: The course aims on understanding of the different assays for the presence of different biomolecules such as, carbohydrates, lipids etc. Students will also have understanding of presence of common adulterants in some samples.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I Colorimetric determination of pK.	20%
Module II Colour reactions of sugars. (Molischs test, iodine test, Saliwanoff test, Fehlings test, Benedicts test, Bials test). Quantitative test for Carbohydrate & Protein. Colour based tests for the identification of common adulterants	40%
Module III Cholesterol estimation Estimation of free fatty acids Estimation of iodine number.	40%

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	10	5	70

MICROBIOLOGY LAB

Course Code: BTB 322 **Credit Units: 01**

Course Contents:

1. Preparation of solid and liquid media.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution.
3. Preparation of slant cultures.
4. Growth curve measurement of bacterial population by turbidometry.
5. Measurement of bacterial population by dilution method.
6. Effect of temperature, pH, carbon and nitrogen sources on growth of bacteria.
7. Microscopic examination of bacteria by gram staining.
8. Endospore staining.
9. Capsule staining.
10. Isolation and identification of Rhizobium from root nodules.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

MOLECULAR BIOLOGY LAB

Course Title: Molecular Biology Lab **Credit Units: 1**
Course Level: UG Level **Course Code: BTB-323**

Course Objectives: The course aims on understanding of the methods of extraction of nucleic acids and proteins from prokaryotes and eukaryotes. Also, students will learn about restriction digestion and ligation.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I Preparation of DNA: genomic, Plasmid	30%
Module II Isolation of RNA & Isolation of Proteins	15%
Module III RFLP analysis	10%
Module IV Agarose Gel Electrophoresis, Gel filtration	15%
Module V Preparation of Competent Cells	15%
Module VI Restriction Digestion and Ligation of DNA	15%

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

DATA STRUCTURES THROUGH C++ LAB

Course Code: CSE 222 **CreditUnits: 01**
Total Hours : 20

Course Objectives:
To write and execute programs in C++ to solve problems using datastructures such as arrays, linked lists, stacks, queues, trees, graphs, hashtables and search trees.To write and execute write programs in C++ to implement various sortingand searching methods.
SOFTWARE REQUIREMENTS: Turbo C++ compiler or GCC compilers
List of experiments/demonstrations:

1. Write a C++ programs to implement recursive and nonrecursivei) Linear search ii) Binary search
2. Write a C++ programs to implement i) Bubble sort ii) Selectionsort iii) quick sort iv) insertion sort
3. Write a C++ programs to implement the following using an array.

a) Stack ADT b) Queue ADT

4. Write a C++ programs to implement list ADT to perform followingoperations
   a) Insert an element into a list.
   b) Delete an element from list
   c) Search for a key element in list
   d)count number of nodes in list

5. Write C++ programs to implement the following using a singly linked list. Stack ADT b) Queue ADT
6 Write C++ programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.
7. Write a C++ program to perform the following operations:
a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.
8 Write C++ programs for implementing the following sorting methods:
Merge sort b) Heap sort
9.Write C++ programs that use recursive functions to traverse the given binary tree in a) Preorder b) in order and c) post order
10 Write a C++ program to perform the following operations
a) Insertion into a B-tree b) Deletion from a B-tree
Course Outcomes:

- Ability to identify the appropriate data structure for given problem.
- Graduate able to design and analyze the time and space complexity ofalgorithm or program.
- Ability to effectively use compilers includes library functions, debuggersand trouble shooting.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
- Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and.Mount, Wiley student edition, John Wiley and Sons.
- Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examinatio**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***
K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.***

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:
To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:
Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999 •Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998. •Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:
Toenablethe students
- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:
Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:
Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin, indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.
Dossier6:AilleursActesdeCommunication:
S'exprimeraupassécomposé,raconterunvoyage, sesituerdanslemonde,exprimerletemps(avecindicateursde temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.
Grammaire :
1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:
Le livre àsuivre:
- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:
- Girardeau,Brunoet NellyMous.Réussirle DELFA1.

TERM PAPER

Course Code: BTB 330 **Credit Units: 02**

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.
The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure
It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References
From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C.” Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network” IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,”Clinical Decision Support System based Virtual Telemedicine”2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada “Intelligent Management of Processes in a ICU Telemedicine System” Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.
Appendix
The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.
Assessment Scheme:

Continuous Evaluation: (Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)	40%
Final Evaluation: (Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)	60%

BIOCHEMISTRY – II

Course Title: Biochemistry-II **Credit Units: 4**
Course Level: UG Level **Course Code: BTB-401**

Course Objectives:

•The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	35%
Proteins -Amino acids and peptides - classification, chemical reactions and physical properties. Introduction to protein structure and function. Cis-trans peptide bond formation. Glycoproteins -structure and function, *Vitamins and Coenzymes*: structure and function of water soluble vitamins. Enzymes -Introduction to kinetic and catalytic mechanisms of enzymes; Regulation of enzyme activity; Effects of physical parameters on enzyme activity, enzyme inhibitors – types of inhibition.	
Module II Anatomy & Physiology of Rabbit	10%
Nucleic acids - nitrogenous bases, nucleotides, types, structure and properties of nucleic acids	
Module III	30%
Amino acid metabolism -Amino acid deamination, urea cycle, biosynthesis and breakdown of nutritionally non-essential amino acids (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine, Disorders of amino acid metabolism, Specialized Products of Amino Acids, Nitrogen fixation	
Module IV	25%
Nucleotide Metabolism -structure and metabolism of purines and pyrimidines, biosynthesis of nucleotide coenzymes (NAD, NADP, FAD, FMN; Catabolism of heam and clinical significance of bilirubin.	

Student Learning Outcomes:

- Understand relationships between structure and functions Amino acids and Proteins.
- Learn the concept of Enzymes, their mode of action and regulation.
- Understand the structure and properties of Nucleic acids – DNA and RNA.
- Learn and understand the amino acid metabolism.
- Understand the metabolism of purines and pyrimidines in the body.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.

Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing

GENETICS

Course Code: BTB 402 **Credit Units: 04**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular and population genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develops knowledge about the basic principles of genetics.
- Learn about concepts of classical, molecular and population genetics.
- Develops knowledge of genes and gene interactions.
- Learn about mutations and chromosomal aberrations.
- Understand role of genetic techniques in pharmaceutical industries.

Course Contents:

Module I

The science of genetics -introduction, history, classical and molecular genetics, role of genetics in medicine, agriculture and society.

Module II: Mendelism

Mendelian inheritance and its applications, Mendelian principles in human genetics and in agriculture.

Extension of Mendelism - Allelic variations, influence of environment on expression, penetrance and expressivity, epistasis, pleiotropy. Chromosomal basis of inheritance; sex linkage,, crossing over and chromosome mapping in eukaryotes.

Module III

Numerical changes and structural changes in chromosomes with emphasis on human disease/syndromes/plant breeding and genetic counseling.

Module IV

Mutation and mutagenic agents, types of mutations, economic importance of mutation

Module V

Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon & nutron) Benzer's work on r II locus in T_2 bacteriophage

Module VI: Genetics of Population

Hardy- Weinburg Law and its deviations.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genetics, P.K. Gupta, Rastogi Publication
- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education

References:

- Genetics, M.W. Strickberger, Prentice Hall College Division
- Genetics, P.J.Russell, Benjamin/Cummings
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.
- Genetics, R. Goodenough, International Thomson Publishing
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company
- Principles of Genetics, D.P. Snustad & M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: BTB 403 **Credit Units: 03**

Course Objective:
The students will be exposed to techniques and instruments that are used in biotech industries.

Learning Outcomes:
After successful completion of the course student will be able to:
- know electrophoresis and their different types and their application.
- know chromatography techniques and their different types and their application.
- Understand different types of spectroscopes and their application analysis.
- Learn about the X-Ray crystallography and diffraction technique

Course Contents:
Module I: Electrophoresis
Agrose Gel electrophoresis, PAGE, SDS-PAGE, isoelectric focusing, two-dimensional electrophoresis, immuno electrophoresis, capillary electrophoresis

Module II: Chromatography
Paper, TLC, gel filtration, ion-exchange chromatography, affinity chromatography, HPLC and GLC

Module III: Spectroscopy
UV and visible spectroscopy ,Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Mass Spectrometry, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy,

Module IV
X- ray diffraction and X-ray Crystallography

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wi

CHEMICAL BIOLOGY

Course Code: BTB 404 **Credit Units: 03**

Course Objective:

Chemical biology is that branch of life science, which deals with the study and manipulation of biological systems through the application of chemical techniques and tools. It differs from the more traditional disciplines of chemistry and biology in its emphasis on integrating a wider series of experimental techniques, ranging from synthetic organic chemistry, to biochemistry, to structural, molecular, and cellular biology. Chemical biology has historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry and metabolic engineering.

Learning Outcomes:

After successful completion of the course student will be able to:

- Know relationships between structure and function carbohydrate, proteins and nucleic acid.
- Learn concept of chemical aspects of signal transduction and cellular targets
- Understand Enzymes and their functions.
- Understand different types of chemical and biochemical reactions.
- Understand the structural chemical biology.

Course Contents:

Module I: Principles of chemical biology

Chemistry of carbohydrates, proteins and nucleic acids, strategies for identifying the cellular target of physiologically active natural products (paclitaxel, vancomycin), chemical aspects of signal transduction

Module II: Chemical reactions in living systems

Introduction to enzyme chemistry, Group transfer reactions, Substitutions, Carboxylation and decarboxylation, Isomerases, Eliminations and additions, Redox reactions (1), Redox reactions (2), Aldol and Claisen Reactions, One-carbon transfer reactions, Rearrangements

Module III: Structural chemical biology

Purine biosynthesis, polyamide biosynthesis, thiamine biosynthesis, vitamin E biosynthesis, proteases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Chemical Biology by H. Gobind Khorana
- Chemical Biology: A practical course, Herbert Waldmann, Petra Janning, Wiley-VCH
- Foundations of Chemical Biology, C.M. Dobson, J.A. Gerrard, A.J. Pratt, Oxford Chemistry Primers
- Innovations in Chemical Biology, Sener Bilge, Springer
- Chemical biology by Stuart L. Shreiber, Tarun Kapoor, Gunther Wess, Wiley-VCH.

References:

- A General Method for Discovering Inhibitors of Protein−DNA Interactions Using Photonic Crystal Biosensors *Chem. Biol.*, 2008, *3* (7), pp 437–448.
- Optimization of non-natural nucleotides for selective incorporation opposite damaged DNA Org. Biomol. Chem., 2007, 5, 3623 – 3630.

JAVA PROGRAMMING

Course Code: CSE 403 **Credit Units: 03**
Total Hours: 30

Course Objective:
The objective is to impart programming skills used in this object oriented language java. The course explores all the basic concepts of core java programming. The students are expected to learn it enough so that they can develop the web solutions like creating applets etc.

Course Contents:

Module I : (07 Hours)
Object Oriented Programming: Concept and features of object-oriented programming, create classes and objects and add methods to a class, Real World Comparison. Evolution of JAVA: History of Java, Requirements and Environment (JDK), Comparison with other languages, Basic Features & Java Architecture-Java Virtual Machine (JVM), Installing Java Development Kit, Program Structure- Data types, Variables and Operators. Arrays

Module II : (07 Hours)
Classes and Objects in Java: Understanding Constructors, Dealing with Garbage Collection. Working with Inheritance in Java: Understanding Abstract Classes and Interfaces. Packages: Introduction to packages, How to implement a package, CLASSPATH Setting for Packages, Types and understanding packages.

Module III : (06 Hours)
Multithreaded Programming: Basic concepts and needs of multi-threading, Life Cycle of a Thread, How to create a thread, Handling Thread Priorities, Enforcing Thread Synchronization, Maintaining Inter-thread Communication. Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow in Exceptions, Use of try, catch, finally, throw, throws in Exception Handling.

Module IV : (07 Hours)
GUI Programming -Introduction to AWT, Window Fundamentals, Working with Graphics, Using AWT Controls and Menus, Understanding Layout Managers. JFC and Swing - A Higher Level of User Interaction, Features of the Java Foundation Classes, Overview of Swing, Components and Containers, Swing Packages, Exploring Swing components ,Generating Swing Application

Module V : (03 Hours)
Event Handling -The Delegation Event Model, Event Classes, Event Listener Interfaces Handling Various Events.

Course Outcomes:
The student will learn:
- Students can perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members
- Students can demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance
- Students can demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems
- Students can demonstrate ability to implement multithreading in the programming.
- To learn syntax and features of exception handling
- Students can demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using Swings.
- To demonstrate the ability to handle Events in the Programming

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:
Text:
- JAVA The Complete Reference by Patrick Naughton & Herbert Schild, TMH
- Introduction to JAVA Programming a primar, Balaguruswamy.

References:
- “Introduction to JAVA Programming” Daniel/Young PHI
- Jeff Frentzen and Sobotka, “Java Script” , Tata McGraw Hill,1999

BIOCHEMISTRY LAB - II

Course Code: BTB 420 **Credit Units: 01**

Course Contents:

Module I

Colour reactions of proteins (Ninhydrin test, Biuret test, Xanthoprotein test).

Estimation of proteins.

Module II

Biochemical estimation of DNA

Biochemical estimation of RNA

Quantitative determination of DNA and RNA by spectrophotometric method using UV range.

Determination of melting temperature of DNA from thermal denaturation characteristics.

Examination Scheme:

IA			**EE**			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS LAB

Course Code: BTB 421 **Credit Units: 01**

Course Contents:

1. Study of gene interaction.
2. Study of chromosomal translocation in Rhoeo discolor.
3. Study of bacterial conjugation.
4. Study of bacterial transduction.
5. Study of physical and chemical mutagens on growth of E. coli.
6. PTC test.

Examination Scheme:

IA			**EE**			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

METHODS AND INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: BTB 422 **Credit Units: 01**

Course Contents:

Module I
Cell disruption techniques

Module II
Centrifugation – low speed and high speed.

Module III
Spectrophotometer techniques

Module IV
Chromatography –Paper Chromatography and Thin Layer Chromatography

Module V
Electrophoresis –SDS Page and Agarose gel electrophoresis.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

JAVA PROGRAMMING LAB

Course Code: CSE 423 **Credit Units: 02**
Total Hours: 40

Course Objective:
programming in the Java programming language, knowledge of object-oriented paradigm in the Java programming language, the use of Java in a variety of technologies and on different platforms.

1. Lab assignment will be based on the following:

1. Use Eclipse or NetBeans platform and acquaint with the various menus. Create a test project, add a test class and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop. :**(02 Hours)**
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero. :**(02 Hours)**
3. Develop an applet in Java that displays a simple message. : **(01 Hour)**
4. Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named "Compute" is clicked. :**(01 Hour)**
5. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 andNum2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box. **:(02 Hours)**
6. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. :**(02 Hours)**
7. Write a Java program that connects to a database using JDBC and does add, delete, modify and retrieve operations. :**(01 Hour)**
8. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially there is no message shown. :**(01 Hour)**
9. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape. : **(01 Hours)**
10. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout. :**(02 Hours)**
11. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes). :**(01 Hour)**
12. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab. It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables). :**(01 Hour)**
13. Implement the above program with database instead of a text file. :**(01 Hour)**
14. Write a Java program that takes tab separated data (one record per line) from a text file and inserts them into a database. :**(01 Hour)**
15. Write a java program that prints the meta-data of a given table. :**(01 Hour)**

Course Outcomes:

- knowledge of the structure and model of the Java programming language, (knowledge)
- use the Java programming language for various programming technologies (understanding)
- develop software in the Java programming language, (application)
- evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
- propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

Note: IA – Internal Assessment, EE- External Exam, A- Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

Text:

- Java Fundamentals - A comprehensive Introduction, Herbet Schidt and Dale Srien, TMH.

References:

- Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI.
- Object Orientd Programming through Java, P. Radha Krishna, Universities Press.
- Thinking in Java, Bruce Eckel, Pearson Education
- Programming in Java, Bruce Eckel, Pearson Education\
- Programming in Java, S. Malhotra and S. Choudhary, Oxford Univ. Press.

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • “The Lottery” 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: ***Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.***

Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: ***Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer’s Companion, Bedford: St. Martin’s Press, 2010. Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.***

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building- New-self awarness

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.

Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulot

ActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’ exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

1. l’imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	TOTAL	END SEMESTER	100
Weightage (%)	15	10	5	30	70	

Text &References:

Text:

Le livre àsuivre:

Andant,Christineetal.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Andant,Christineetal.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:Girardeau,Brunoet NellyMous.RéussirleDELFA1.Paris: Didi

PLANT BIOTECHNOLOGY

Course Title: PLANT BIOTECHNOLOGY **Credit Units: 3**

Course Level: UG Level **Course Code: BTB-501**

Course Objectives:

•The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	25%
Historical perspective of plant tissue culture. Tissue culture lab and organization Sterilisation techniques Types of nutrient media and media composition Plant regeneration pathways Role of phytohormones Cell culture techniques- cell, tissue, organ cultures, callus culture, suspension culture Culture techniques Callus culture, cell culture and protoplast cultures.	
Module II	20%
Organogenesis and somatic embryogenesis. Applications of plant tissue and cell culture. Micropopogation, pathogen free plants. production haploids, Somaclonal variation.preservation of germplasm.	
Module III	20%
Genetic engineering in plants, - transformation vectors Gene transfer techniques-vector meditated and vector less gene transfer. Transgenic plants Tran's gene integration and expression	
Module IV	20%
Transgenic crop with new traits-herbicide tolerance, insect and disease resistance, Therapeutic proteins and compounds Oral vaccines Production of secondary metabolites through plant tissue culture, root culture/A. rhizogene transformation and industrial applications Bioethics of plant genetic engineering.	
Module V:	15%
Success stories in plant biotechnology for some of the important crops like Banana, Cotton etc, Fundamental of automation in plant tissue culture and disruptive technologies like sensors etc.	

Student Learning Outcomes:

- Explain the basics, methodology and applications of plant tissue culture.
- Understand sterilization and Media preparation and organ culture.
- Learn *invitro* germination, micropopogation and Somaclonal variation.
- Understand knowledge of isolation and transformation gene in plants.
- Learn various applications of GM crops.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Adacemic/Plenum Press

Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Title: ANIMAL BIOTECHNOLOGY **Credit Units: 3**
Course Level: UG Level **Course Code: BTB-502**

Course Objectives:

The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Pre-requisites: The students must possess fair understanding of ……………………………..

Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering. Cell-culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures.	
Module II	15%
In-Vitro Fertilization (IVF) and Embryo Transfer Technology (ETT).	
Module III	20%
Somatic cell hybridization, Hybridoma technology and Production of Monoclonal antibodies.	
Module IV	20%
Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer, Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc. Bioethical issues related to animal biotechnology.	
Module V	15%
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).	
Module VI	10%
Fundamentals of Stem cell based therapy, Regenerative medicines	

Student Learning Outcomes:

- Concepts of animal biotechnology and its commercial applicability
- Understand sterilization techniques, understanding of organ culture.
- Learn methods of animal cell culture and maintenance and immobilization techniques.
- Understand concepts in-vitro fertilization and embryo transfer for live stock improvement.
- Become familiar with concept of somatic hybridization and transgenic technology.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

STRUCTURAL BIOLOGY

Course Code: BTB 503 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand the structure of protein emphasizing on significance of side chain.
- Know the classical theories of enzyme substrate interaction, description of cell signaling.
- Understand the protein denaturation, refolding and stabilization.
- Understand structural parameters of DNA molecule.
- Understand the protein-DNA interaction and its mechanism.

Course Contents:

Module I: Chemistry of amino acids and peptides

Side chain structure and function in protein folding and functionality: Secondary structure of proteins -helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Structure and function of an antibody; structure of hemoglobin, muscle proteins; Sequence and structural motifs in proteins.

Module II: Protein-ligand interactions

Lock and key versus handshake mechanism of substrate recognition; structural basis of recognition; reaction mechanisms of enzymes, G-Protein coupled receptors.

Module III: Protein solubility, protein stability and stabilization

Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding

Module IV: DNA structure

Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules -Rasmol, Deepview, Whatif.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemistry, R.H. Abeles, P.A. Frey and W.A. Jencks, Jones and Bartlett.
- Essentials of Molecular Biology, D. Freifelder, Jones and Bartlett Publications.
- Genes VII, B. Lewin, Oxford University Press.

References:

- Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company.
- Protein Structure, M. Perutz, Oxford University Press.
- Proteins (Structures and Molecular Properties), T.E. Creighton, W.H. Freeman and Company.
- Database Annotation in Molecular Biology, Arthur M. Lesk.
- From Genes to Clones, E.L. Winnacker.
- Genes & Genomes, M.S. Paul Berg.
- Structure and Machanism in Protein Science, Alan Fersht.

CHEMICAL ENGINEERING PRINCIPLES

Course Code: BTB 504 **Credit Units: 03**

Course Objective:

The knowledge gained through chemical reaction engineering and material and energy balances will help the students to understand the tools and techniques of biotechnology.

Course Contents:

Module I: Material and Energy Balances

Units and dimensions, Dimensional analysis; Simple problems on material balance calculations involving unit processes and reactive systems; Available electron balances.

Basic energy concepts -enthalpy changes in chemical/biochemical reactions and in non-reactive processes, Energy balance calculations, Use of Steam tables; Heat of reaction and energy balance for microbial processes.

Module II: Chemical reaction engineering

Kinetics of homogenous reactions: Concepts of reaction rate, order of reaction and molecularity, Analysis of batch reactors for kinetic interpretation of data and isothermal reactor design for single and multiple reactions, Design equations for CSTR and plug flow reactors.

Module III: Instrumentation and process control

Principles of measurement: error, accuracy and sensitivity; Measurement of flow, pressure, temperature, level, pH, viscosity and chemical composition.

Basic concepts of feedback control, control loop and its elements, Dynamic behaviour of first, second and higher order physical systems, controller hardware, choice of controllers and settings. Introduction to advanced control systems: feed forward, cascade and ratio control.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Principles and Calculations in Chemical Engineering, D.M. Himmelblau, Prentice Hall
- Basic Principles of Chemical Engineering, E.I. Shaheen, Houghton Mifflin

References:

- Chemical Process Control, An introduction to Theory and Practice, G. Stephanopoulos, Prentice Hall Inc.
- Chemical Reaction Engineering, O. Levenspiel, John Wiley and Sons Inc.
- Elementary Principles of Chemical Processes, R.M. Felder and R.W. Rousseau, John Wiley and Sons Inc.
- Fundamentals of Chemical Reaction Engineering, C.D. Holland and R.G. Anthony, Prentice Hall Inc.
- Process Modelling, Simulation and Control for Chemical Engineers, W.L. Luyben, McGraw Hill

BASIC BIOANALYTICAL TECHNIQUES

Course Code: BTB 505 **CreditUnits: 03**

Course Objective:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

Learning outcomes:

After successful completion of the course student will be able to:

- Get familiar with working principles, tools and methods of analytical techniques.
- Understand the strengths and limitations of the basic instruments used in a biotechnology lab.
- Get an overview of the instruments used in separation and isolation of biomolecules.
- Learn the basic principle of microscopy and the concept of radioisotopes and their applications.
- Learn physical, chemical and biological method of cell disruption, reverse osmosis.

Course Contents:

Module I: Solution and Buffers
Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.

Module II: Centrifugation
Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation.

Module III:Microscopy
Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy.
Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

Module IV: Radioisotope techniques
Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio – immunoassay.

Module V
Cell Disruption techniques, ultra filtration, dialysis and reverse osmosis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Essentials of Biophysics, P. Narayanan, New Age International Publishers

References:

- Advanced Instrumentation, Data Interprtation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Crystallography made Crystal Clear, G. Rhodes, Academic Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.

ADVANCED PROGRAMMING THROUGH PYTHON

Course Code: CSE 510 **Credit Units: 03**
Total Hours: 30

Course Objective:
To understand the basic concepts such as lists, tuples and dictionary Data structures. To understand concepts like networking and website development using frameworks of python. To understand working third party libraries in python. To understand Scientific programming paradigm.

Course Contents:

Module I: Introduction of Python: (08 Hours)
History of Python, Features of Python Programming, Applications of Python, Use of python, install and Run Python in Windows/Linux, Keyword and Identifier, Statements and Comments, Python Variables, Python Data types, Python Type Conversion,Python I/O and Import, Python Operators, Python Namespace.
Python If-else statements, Python for Loop, while loop, break and continue, String manipulation, List Tuple, dictionaries, pass statement, looping technique, functions, function arguments, recursion,anonymous function, python global, local and Nonlocal.

Module II: Object and Class: (05 Hours)
Python modules, python package, File operation, Python directory, Python exception, Exception Handling, User-Define Exception, Python OOP, class, inheritance, multiple inheritance, operator overloading.

Module III: Regular Expression, CGI and Database: (08 Hours)
Match function, Search function, matching vs. searching, modifier, pattern, Introduction of CGI,CGI Architecture, CGI environment Variable, GET/POST Method, Cookies,File upload, Introduction of Database, connections, Executing queries, transactions, handling errors.

Module IV: GUI Programming: (09 Hours)
Tkinter Programming, Tkinter widgets, Standard Attributes, CGI Programming, Introduction to Web Framework: - Django, Application Lifecycle, creating a Django Project, Creating Admin Interface, Creating Views, URL Mapping, Template System, Creating Database Models, Interfacing database: - PostgreSQL with the Django Project, Page Redirection, Form Processing.

Course Outcomes:

- Ability to create client-server application for real world problems.
- Ability to apply Regular Expression, CGI and Database.
- Ability to apply GUI Programming in real world problems.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination;

Text & References:

Text:

- Core Python Programming , Wesley J. Chun, Publisher: Prentice Hall PTR, First Edition.
- Django Unleashed, Andrew Pinkham, SAMS, second edition
- OpenCV 4, Roy Shilkrot, Packt Pub, third edition
- Elegant Scipy, Juan Nunez, O'Reilly, third edition.

Reference:

- Learning Python, Mark Lutz, O'Reilly. Ltd., Second Edition.
  Python CookBook, Alex Martelli, O'Reilly. Ltd., Third Edition

PLANT BIOTECHNOLOGY LAB

Course Title: Plant BiotechnologyLab **Credit Units: 1**
Course Level: UG Level **Course Code: BTB-520**
Course Objectives:
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	30%
Sterilization of glasswares and equipments. Preparation of cotton plugs and culture media Preparation of stocks for culture media Preparation of culture media	
Module II	30%
Preparation and sterilization of different explants Inoculation of explants on culture media	
Module III	30%
Study of viability of seeds Embryo culture,	
Module IV	10%
Agrobacterium mediated transformation studies in plants	

Student Learning Outcomes:

Pedagogy for Course Delivery: Demonstration, on-site training and hands-on experiment and interpretation

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

ANIMAL BIOTECHNOLOGY LAB

Course Code: BTB 521 **CreditUnits: 01**

Course Contents:

1. Preparation, standardization and sterilization of culture media
2. Inoculation of specific tissues for callusing
3. Inoculation and maintenance of cell lines
4. Study of toxicity on cell lines

Examination Scheme:

IA			**EE**			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

STRUCTURAL BIOLOGY LAB

Course Code: BTB 522 **Credit Units: 01**

Course Contents:

1. Study of physical properties of proteins.
2. Analysis of protein structure.
3. Study of protein finger printing
4. Study of protein fractionation
5. Study of protein folding
6. Study of protein degadation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED PROGRAMMING THROUGH PYTHON LAB

Course Code: CSE 530 **Credit Units: 01**
Total Hours: 20

Course Objective:
To write and execute programs in python to solve problems using data structures such as lists, tuples, dictionaries.
To write and execute write programs in python to implement various networking, web applications
SOFTWARE REQUIREMENTS: Python 3
List of experiments/demonstrations:

5. Write a python program to demonstrate working of lists.**: (02 Hours)**
6. Write a python program to demonstrate working of tuples. **: (02 Hours)**
7. Write a python program to demonstrate working of dictionaries and conditional statements**: (02 Hours)**
8. Write a python program to demonstrate working of Inheritance and other OOP concepts. **: (02 Hours)**
9. Write a python program to demonstrate regular expressions like match function, search function, pattern search function. **: (02 Hours)**
10. Write a python program for reading data from CSV file. **: (02 Hours)**
11. Write a python program for writing data in CSV file. **: (02 Hours)**
12. Write a python program for reading data from text file. **: (02 Hours)**
13. Write a python program for writing data from text file. **: (01 Hour)**
14. Write a python program for image analysis using openCV. **: (01 Hour)**
15. Write a program to demonstrate connection with postgresql **: (01 Hour)**
16. Develop a dynamic website using Django framework and postgresql as backend. **: (1 Hour)**

Course Outcomes:

- Ability to create client-server application for real world problems.
- Ability to develop multithreaded application.
- Ability to create web application for real world problem.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

Note: IA –InternalAssessment, EE- External Exam, A- Attendance, PR- Performance, LR – Lab Record, V – Viva.

Text & References:

- Core Python Programming , Wesley J. Chun, Publisher: Prentice Hall PTR, First Edition.
- Python: The Complete Reference, Martin C Brown, McGraw Hill Publications.
- Programming Python, Mark Lutz, O'Reilly. Ltd., Second Edition.

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary** • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	**35% Weightage**
2.	**Module II Comprehension Skills** • Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	**25% Weightage**
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in PresentationSkills. • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
AdditionalReading:NewspapersandJournals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

- narratingevents inthe past, markingthestages, usingappropriateconnectors
- expressingcausesandconsequences, usingappropriate logical connectors
- presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensemble
ActesdeCommunication:
Exprimerlacause,l’opposition,laconséquence,décrirelesétapesd’uneaction,s’exprimersurl’environnement,
l’écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd’une association,fairela biographied’une personne.

Dossiers4, 5,6–Révision
Exercicesd’écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

SUMMER PROJECT - I

Course Code: BTB 560 **Credit Units: 05**

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

RECOMBINANT DNA TECHNOLOGY

Course Code: BTB 601 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Learning outcomes:

After successful completion of the course student will be able to:

- Learn manipulating DNA sequences with versatile DNA modifying enzymes.
- Designing cloning experiments, genomic and cDNA library construction etc.
- Understand PCR amplification, DNA modifying enzynes and blotting techniques.
- Learn genomic sequences analysis by using different techniques.
- Develop knowledge in conducting experiments involving genetic manipulation.

Course Contents:

Module I: Enzymes used in RDT

Restriction endonuclease, methyltransferase, ligase, polymerase, kinase, phosphatase, nuclease, transferase, reverse transcriptase.

Module II: Cloning vectors

Plasmids, bacteriophages (Lambda and M13), phagemids, cosmids, artificial chromosomes (YAC, BAC). expression vectors (Bacteria and yeast), vector engineering (fusion tags, antibiotic markers), codon optimization, host engineering

Module III: Blotting techniques and hybridization

Southern, Northern and Western blotting techniques. Radioactive and non-radioactive probes.

Module IV: Nucleic acid amplification and its applications

Principles of PCR, designing of primers

Module V: Cloning Techniques

Basic cloning experiment: Design of cloning strategy and stepwise experimental procedure , Complementation, colony and plaque hybridization, restriction, PCR, plus-minus screening, immunoscreening.

Module VI: DNA Libraries

Purpose of constructing DNA libraries. Construction of cDNA and genomic libraries.

Module VII: Sequencing of DNA

DNA sequencing (Maxam Gilbert, Sanger's and automated), protein engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc.
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company.

References:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press.
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor
- Laboratory Press.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: BTB 602 **Credit Units: 03**

Course Objective:
The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Learning Outcomes
After successful completion of the course student will be able to:
- Undertsnad the principles of enzymes therapeutic, clinical diagnosis, mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn applications of immobilization of enzymes in industrial production of antibiotics etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Course Contents:

Module I: Enzymes
Introduction and scope, Nomenclature, Mechanism of Catalysis.

Module II: Enzyme Kinetics
Single substrate steady state kinetics; Michaelis Menten equation, Linear plots, King-Altman's method; Inhibitors and activators; Multisubstrate systems; ping-pong mechanism, Alberty equation, Sigmoidal kinetics and Allosteric enzymes

Module III
Immobilization of Enzymes; Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects.

Module IV: Enzyme reactors
Reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems, Mass transfer in enzyme reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reaction.

Module V: Bioprocess Design
Physical parameters, reactor operational stability, Immobilized cells.

Module VI: Challenges and future trends
Enzyme catalysis in organic media; catalytic antibodies and non protein biomolecules as catalysts, biocatalysts from extreme thermophilic and hyper thermophilic Archae and Bacteria.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:
Text:
- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.

References:
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner.
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience.
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Title: IMMUNOLOGY AND IMMUNOTECHNOLOGY **Credit Units: 4**
Course Level: UG Level **Course Code: BTB-603**

Course Objectives:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Pre-requisites: The students must possess fair understanding of immunology and immunotechnology.

Course Contents/Syllabus:

	Weightage (%)
Module I: **Introduction to immune system**	20%
Phylogeny of Immune System, Innate and acquired immunity. Clonal selection theory Immune response. Types of immunity- innate, acquired, active and passive. Organization and structure of lymphoid organs. Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T - Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells	
Module II: **Antigen and Antibody**	20%
Nature and Biology of antigens and super antigens. Antigen processing and presentation. Antibody structure types and functions. Measurement of antigen – antibody interaction: Affinity, Avidity, Cross reactivity, Agglutination, Precipitation Immunodiffusion, Immuno-electrophoresis, ELISA, RIE, Western blotting, Fluorescent antibody techniques. Generation of antibody diversity, Heavy chain and light chain gene rearrangement Hybridoma technology and its applications.	
Module III: **Nature and function of cell surface molecule**	10%
MHC: Types, structure and MHC restriction. B-Cell Receptor: Structure and Roles, B-cell co-receptor. Ig superfamily, T-Cell Receptor : Structure and Roles, Organization and Rearrangement of TCR Genes, T-Cell Receptor Complex: TCR-CD3, T-Cell Accessory. Alloreactivity of T Cells.	
Module IV: **Cell activation and differentiation**	20%
T-Cell Maturation, Activation, and Differentiation. B-Cell Generation, Activation, and Differentiation, cytokines and their role in immune regulation	
Module V: **Mechanism of Immune Response**	20%
Complement system: Classicle, lectin and alternative pathways and their regulation. Biological Consequences of Complement Activation Hypersensitivity: Type I, II,III and IV hypersensitivity reaction and role of immune system. Cell mediated toxicity: Mechanism of T cell and NK cell mediated lysis and macrophage mediated cytotoxicity Immune Response to Infectious Diseases (viral, bacterial and protozoan) Autoimmunity: Organ-Specific Autoimmune Diseases ■ Systemic Autoimmune Diseases. Tumor immunology. Transplantation	

Immunology Vaccines: General consideration, ideotype network hypothesis, Synthetic vaccines	
Module VI: **Immunophysics and Immunoinformatics**:	10%
Immunoinformatics: Immunomics B cell and T cell databases. Webservers and tools for prediction of B-cell epitopes, T-cell epitopes, allergy and *in-silico* vaccine designing. Introduction of immunophysics techniques and applications.	

Student Learning Outcomes:

- Understand the phylogeny of immune system, types of immunity and immune response.
- Understand the organization and structure of lymphoid organs and immune cells
- Understand and explain the concept of antibody and antigen.
- Understand and explain the concept and types of hypersensitivity and vaccination.
- Understand the mechanism of autoimmune disorders, transplantation and immune response against tumor

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

COMPUTATIONAL BIOLOGY

Course Code: BTB 604 **Credit Units: 03**

Course Objective:

The objective is to describe relational data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures genetic mapping etc.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand the nucleotide and protein sequence retrieval, submission, analysis through NCBI.
- Understand the nucleotide and protein sequence alignment methods through different algorithm.
- Understand the use of nucleotide sequence for the prediction of phylogenetic tree and evolutionary relationship are emphasized.
- Know the concept of gene discovery and identification along with structural description.
- Know the vast description of molecular modeling and protein-ligand docking.

Course Contents:

Module I: Introduction and overview

The NCBI data model; sequence databases, sequence retrieval, sequence file formats, submitting DNA and protein sequences.

Types of biological databases, Databases and rapid sequence analysis

Module II: Sequence alignment

Global and local alignments, statistical significance of alignments, scoring matrices and gap penalties, filtering, position specific scoring matrices, internet resources, Pairwise and multiple alignment, uses of pairwise and multiple sequence alignment, programs and methods for sequence alignment, pattern searching programs, family and superfamily representation, structural inference, dynamic programming algorithms, alignment by hidden Markov models, consensus word analysis, more complex scoring.

Module III: Phylogenetic prediction

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module IV: Predictive methods using DNA and protein sequences

ESTs – databases, clustering, gene discovery and identification, and functional classification.

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification;

Module V

Molecular modeling – PDB and MMDB, structure file formats, visualizing structural information, advance structure modeling, Internal and external co-ordinate system, cartesian and cylindrical polar co-ordinate system, Potential energy calculations using semiempirical potential energy function, Molecular mechanics and dynamics, Docking of Molecules, Knowledge base structure prediction, Molecular Design, structure similarity searching; Secondary structure prediction in proteins, prediction of buried residues in proteins;

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F Quellette, Wiley – interscience.
- Bioinforamtics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. Von Heijne and G. Von Heijne, Academic Press.

FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Course Code: BTB 605 **Credit Units: 03**

Course Objective:

The course material on the kinetics of microbial growth, substrate utilization and product formation etc. may help the students to understand the various principles involved in instrumentation and control of bioprocess.

Learning outcome:

After successful completion of the course student will be able to:

- Learn the different phases of microbial growth, kinetics of substrate utilization and product formation.
- Understand various sterilization techniques and its principles.
- Familiarize themselves with the different parts, function and types of bioreactors and valves.
- Understand the mass transfer phenomenon, principles involved in instrumentation and control of bioprocess.

Course Contents:

Module I

Kinetics of microbial growth, substrate utilization and product formation.

Module II

Sterilization of air and medium.

Module III

Batch, continuous ,cell recycle and fed batch reactors; mass and energy balance in microbial processes, Bioreactor design, Different types of bioreactors, their parts and functions. Different types of valves.

Module IV

Mass transfer in Biological reactions; Scale-up principles; Instrumentation and control of bioprocesses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Biochemical Engineering Fundamentals, J E Baily and D F Oillis, McGraw Hill
- Bioprocess Engineering Principles, P Doran, Academic Press

References:

- Chemical Engineering, J M Coulson, and J F Richardson, Butterwirth Heinemann
- Fermentation and Biochemical Engineering Handbook: Principles, Process Design, and Equipment, HC Vogel, CL Todaro, CC Todaro, Noyes Data Corporation/Noyes Publications
- Process Engineering in Biotechnology, A T Jackson, Prentice Hall

RECOMBINANT DNA TECHNOLOGY LAB

Course Code: BTB 620 **Credit Units: 01**

Course Objective:

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:

Module I

Study of cloning (GFP CLONING)

Module II

Study of PCR

Module III

Study of Southern hybridiosation

Module IV

Study of RAPD

Module V

Site directed mutagenesis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code:BTB 621 **CreditUnits: 01**

Course Objective:

The laboratory will help the students to isolate enzymes from different sources, enzyme assays and studying their kinetic parameters which have immense importance in industrial processes.

Course Contents:

Module I

Isolation of enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulase, protease.

Module III

Purification of Enzyme by ammonium sulphate fractionation.

Module IV

Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity, determination of Michaelis-Menten constant (K_m) and Maximum Velocity ($V_{max.}$) using Lineweaver-Burk plot.

Module V

Effect of Temperature and pH on enzyme activity.

Module VI

Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: BTB 622 **CreditUnits: 01**

Course Contents:

Module I
Blood film preparation and identification of cells.
Module II
Identification of blood group.
Module III
Isolation of serum.
Module IV
Lymphoid organs and their microscopic organization.
Module V
WIDAL Test
Module VI
Radial Immuno Diffusion Test
Module VII
Ouchterlony Double diffusion Test
Module VIII: Elisa
DOT, SANDWICH
Module IX
Purification of lgG through affinity chromatography
Module X
Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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COMPUTATIONAL BIOLOGY LAB

Course Code: BTB 623 **CreditUnits: 01**

Course Contents:

List of Experiments/Exercises.

1. Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
2. Local and Global Alignment- concepts Pair wise sequence alignment
3. Multiple sequence alignment
4. Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm
5. Motif and pattern searching
6. Phylogentic prediction and analysis
7. Structure predicition
8. Finding transcription regulatory signals
9. Docking

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 — Credit Units: 1

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12
Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

BIOPROCESS TECHNOLOGY

Course Code: BTB 701 **Credit Units: 03**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

Learning Outcomes

After successful completion of the course student will be able to:

- Know the advantages of biochemical processes and its conventions.
- Develop skill of process technology for ethanol, amino acids and biomass production.
- Gain understanding of production of secondary metabolites and antibiotics.
- Get knowledge of industrial production of enzymes.
- Develop knowledge of growth and death kinetics.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process

Module II

Process technology for the production of primary metabolites, eg. Biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides

Module III

Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture

Penicillin: Classification, various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc.

Streptomycin: chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc.

Tetracycline: chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.

Module IV

Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Bioprocess Engineering Principles, P Doran, Academic Press
- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press
- Process Engineering in Biotechnolgy, A T Jackson , Prentice Hall

DOWNSTREAM PROCESSING

Course Code: BTB 702 **Credit Units: 03**

Course Objective:

The syllabus will help the students to characterize the Bioproducts due to downstreaming process of biotechnological importance.

Learning out comes:

After successful completion of the course student will be able to:

- Learn the principles and application of downstream processing.
- Understand comprehensive knowledge of bio-product and their characteristics.
- know protein precipitation and separation methods.
- Learn basics and applications of various chromatography techniques.
- Know about membrane based sepration of bio-products such as dialysis, filtration etc.
- Learn various crystallization and drying techniques.

Course Contents:

Module I

Characteristics of Bioproducts; Coagulation, Flocculation and conditioning of broth.

Module II

Mechanical separation; Cell disruption techniques

Module III

Protein precipitation and separation

Module IV

Aqueous- two- phase extraction, Adsorption-desorption processes

Module V

Chromatographic methods of separation based on size, charge, hydrophobic interactions and biological affinity

Module VI

Membrane based separation; Dialysis, Electrodialysis; Micro filtration, Ultra filtration; Electrophoresis

Module VII

Crystallization; Drying

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill.
- Bioseparatioins, P.A. Belter, E.L. Cussler and W.S. Hu, John Wiley and Sons Inc.Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering / Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society.
- Protein Purification, M.R. Ladisch, R.C. Willson, C.C. Painton and S.E. Builder, American Chemical Society.

STATISTICS FOR BIOLOGY

Course Code: BTB 703 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice.

Learning Outcomes:

After successful completion of the course student will be able to:

- Fundamental knowledge of basic statistical Techniques.
- Relationship between Statistics and Biostatistics
- Various Statistical Tools used in data presentation and interpretation
- Correlation and Regression Techniques.
- Application of statistical methods to handle biological data.
- Application of Biostatistical Tools in hypothesis testing.

Course Contents:

Module I

Statistics and Biostatistics: Preliminary concepts.
Measures of Central Tendency: Mean, Median, Mode
Measures of Dispersion: Range, Standard deviation, Variance

Module II

Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.

Module III: Continuous Distribution

Normal Distribution, Properties of Normal distribution

Module IV: Correlation

Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, some examples.

Module V: Regression

Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples. Method of least square: Fitting of straight line

Module VI: Introduction to the following Statistical terms

Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications.
Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test.
Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means.
Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity.
Analysis of Variance: One way and two way (only Examples)

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
- Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
- Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand & Co.

References:

- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons
- Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
- Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

BIOSENSORS

Course Code: BTB 704 **Credit Units: 03**

Course Objective:

The course aims at developing an understanding of Biosensor technology needed critically for the development of small, sensitive, and selective biosensor devices and detection systems that can reliably operate in real time and in extreme and diverse physical environments. Biosensors are important tools in food safety diagnostics, medical monitors, and detection systems for biological warfare agents.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, Signal Transduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections of NH4+ cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change in light reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors and trnsducers, who do we need Biomedical sensors and Transducers? Important Design considerations and system calibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Affinity Biosensors: Techniques and Protocols, K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applicatrions, V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors, B.R. Eggins, John Wiley and Sons Inc.
- Sensors and Sensing in Biology and Engineering, F.G. Barth, wt al, Springer Verlag.

THERMODYNAMICS OF BIOLOGICAL SYSTEMS

Course Code: BTB 705 **Credit Units: 03**

Course Objective:

The main aim is to understand the basis of theories related to combustion and dissolution. It will help in the study of heat evolution, control of dissipation and will suggest ways for solving the rate phenomena through the dynamics of mass transfer applicable to biological process

Course Contents:

Module I
Energy, thermodynamics and living processes - an introduction

Module II
Energetic processes in the biosphere: The ecosystem.

Module III
Thermodynamics systems: equilibrium, activity coefficients and phase equilibrium functions of state, cyclic processes, work, energy and metabolic heat; Mechanical equivalent of heat, energy as a function of state.

Module IV: The laws of thermodynamics
Second law; Reversible vs. irreversible processes entropy, work; Combination of the first and second law, Free energy, useful work and delta G. Entropy: Ideality and Molecular Cohesion, Probabilistic nature of Entropy, Order and Disorder.

Module V: Biological systems as open, non-equilibrium systems
Failure of classical thermodynamics in describing biological processes, Standard free energy changes and equilibrium constants, direction and rate.

Module VI: Chemical potential
Visualization of the potential velocity and steady flow; Fick's law and diffusion. Local Equilibria and steady state: Energy vs. Power; Transducers in biological states, Constitutive equations, Dynamic efficiency and Onsager (nonequilibrium thermodynamics), Prigogine's principle, Spontaneous coupling and entropy production.

Module VII: Non-equilibrium thermodynamics
Reversible work, exact differentials and function of state, first and second law, The electrochemical potential, External forces an steady state, Fick's Law, chemical reactions in the steady state, internal entropy production, cells as non-equilibrium stationary states; Diffusion and membrane transport. Thermodynamic analysis of oxidative photophospghorylation, stability of non-equilibrium stationary states, ordering in time and space far from equilibrium, glycolytic oscillations, biological clocks, routes to chaos.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Bioenergetics, A.L. Lehninger, W.A. Benjamin Inc.
- Biological Thermodynamics, D.T. Haynie, Cambridge University Press.
- Biophysical Chemistry, C.R. Cantor and P.R. Schimmel, Freeman
- Physical Chemistry: Principles and Applications in Biological Sciences, I. Tincoco, K.Sauer and J.C. Wang, Prentice Hall College Division.
- Physical Chemistry for the Chemical and Biological Sciences, R. Chang, University Science Books
- Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, John Wiley and Sons Inc.

PHARMACEUTICAL CHEMISTRY AND DRUG DESIGN

Course Code: BTB 706 **Credit Units: 03**

Course Objective:

The main objective of this course is to make the students well conversant with different molecules that exert a pharmacological action in the body and how the specific action is generated. The contents will introduce them to various drug molecules used in treatment, mitigation and cure of different disease. The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Course Contents:

Module I

Introduction of pharmaceutical Chemistry, Overview of drug discovery process.

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, sites of loss, Solubilities and partition coefficients (Ferguson, Hansch), Drug-receptor interactions, Steric features of drugs, The drug receptor, structure-Activity Relationships, Representatives physicochemical properties as relation to biological action

Module II: Drug Targets and their validation

Drug targets classification-DNA, RNA, post-translational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptide receptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins

Validation Strategies

Module III: Drug Design Strategies

A. Structure-based design-Docking and denovo methods

B.Design and development of combinatorial libraries for new lead generation

The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics, preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability, optimization of ADME characteristics, physico-chemical properties calculation, chemiometrics in drug design.

C. QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development.

Module IV

Drug toxicity, tolerance, dependence, addiction, Dose Response curves

Module V

Survey of various Drug Classes – Anaesthetics (general, local), Analgescis, Neurotransmitters (adrenergic, cholinergic effects; psychopharmacology), CNS depressants (sedative/hypnotic, major/minor tranquilizers), CNS, Stimulants, Antibiotics (especially b-lactam), Steroids- Mechanism of action and applications

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press
- Pharmaceutical Dosage forms and Drug Delivery Systems, H.C. Ansel , L.V. Allen, N.G. Popovich, Lippincott Williams and Wilkins Publishers
- Review of Organic Functional Groups: Introduction to Medicinal Organic Chemistry, T.L. Lemke, Lea and Febiger

CURRENT TOPICS IN BIOTECHNOLOGY

Course Code: BTB 707 **Credit Units: 03**

Course Objective:

A complete understanding of the application of biotechnology in various fields can be understood by studying the various modules of this paper. Success of biotechnology depends largely on how it can be effectively utilized in finding solutions to many vexed problems of present day society. The objective of this paper is to familiarize the students with some of the frontier areas if biotechnological applications where a huge scope for further contributions for betterment of the society exists. The paper shall be a interface between the students and the social at large.

Course Contents:

Module I: Bioremediation

Introductory concept, Bioremediation principles, mechanism for Bioremediation of air, water and soil pollutants, bioremediation examples, commercial application of bioremediation techniques, recombinant DNA technology and bioremediation, bioremediation models, bioremediation software

Module II: Genetically modified organisms

Genetically modified food crops, food animals – examples and mode of production, future goals in GM food crops and animals, scientific evaluation of public concerns, legal requirements in production of GMO, current trends and consumer acceptance.

Module III: Molecular medicine

Gene mutation, point mutation, allele specific oligonucleotides, ARMS, oligonucleotide ligation, disease diagnosis with linked genetic markers, fluorescently labeled DNA sequencing.

Module IV: Nano-biotechnology

Introduction, definition, hybrid nanopracticles, smrat drug delivery, gene sensors, biomolecule control, nanofluids, nanotechnology in medicine.

Module V: Stem cells

Definition, properties, proliferation, culture of stem cells, medical applications of stem cells, ethical and legal issues in use of stem cells.

Module VI: Cancer Biology

Types of cancer, development, causes and properties of cancer, viruses (Hepatitis B & C, SV4U, polymo marines, pupillomarines, adenosines, retrovineses); retroviral oncogenes, proto-oncogenes, turmor suppressor genes, recent advances in detection and treatment of cancer.

Module VII: Forensic Biotechnology

MLP, SLP technology, PCR technology in crime detection, STR and databases, mitochondrial DNA and Y chromosome analysis in forensic science, DNA chip technology, role of molecular biology and biotechnology in crime detection.

Module VIII: Bio sensor

Biological reaction, amperometric biosensor, potentiometric biosensor, conductimetric bioseosors, calorimetric biosensor, piezoelectric biosensor, whole-cell biosensor, immunosensors.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- The Cell – A molecular Approach, 3rd Edn, Geoffrey M. Cooper and Robert E. Hausman, ASM Press
- Molecular Biology and Biotechnology, 4th Edn, J.M Walker and R. Rapley, Panima Books
- Cell Biology, David. E. Sadava, Panima Books
- Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press
- Environmental Microbiology, 2nd Edition, Ian L.Pepper and Charles P. Gerba, Elsevier Pub.
- Environmental Biotechnology – Concepts and Application, Hans – Joachim Jordening and Jesefwinter – Wiley – VCH

ENVIRONMENTAL BIOTECHNOLOGY

Course Title: Environmental Biotechnology **Credit Units: 03**
Course Level: UG Level **Course Code: BTB 708**

Course Objectives:

Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents/Syllabus:

	Weightage (%)
Module I :	
Introduction Ecology and ecosystem. Environmental pollution Water, soil and air, noise and thermal pollution,their sources and effects.	20%
Module II:	
Waste water (sewage and industrial effluents) treatments Anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria-technical process and conditions, emerging biotechnological processes in waste - water treatment.	20%
Module III:	
Solid waste management Landfills, composting, earthworm treatment, recycling and processing of organic residues. Hazardous wastes Hazardous wastes: source management and safety.	20%
Module IV:	
Biodegradation Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution Microbial leaching and mining Microbial leaching and mining: Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.	20%
Module V:	
Wasteland: Uses and management, bioremediation and bio-restoration of contaminated lands. Environmental genetics Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.	20%

Student Learning out comes:

After successful course completion the course students will be able to-

- Understand environmental components and their delicate interrelationship and pollutions.
- Learn concepts of waste water treatment using biotechnological interventions.
- Understand the concept and theory of solid waste disposal methods.
- Understand microbial role in bioremediation of various xenobiotic.
- Build up understanding the mechanism of microbial leaching and mining of metals from ores, wasteland and their restoration and the role of genetically modified microbes.

Pedagogy for Course Delivery: Class room lecture and power point presentation, students are encouraged in active interaction during classroom discussion

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Biotechnology by PK Mohapatra

References:

- Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Microbial Gene Technology: H. Polasa (ED.) South Asian Publishers, New Delhi.
- BiotreatmentSystems, Vol.22, D. L. Wise (Ed.), CRCPress, INC.
- Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association.

BIOPROCESS PLANT DESIGN

Course Code: BTB 709 **Credit Units: 03**

Course Objective:

The objective of this paper is to include not only the application of chemical engineering principles/unit operations to bioprocess systems but also to include the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Course Contents:

Module I

Introduction; general design information; Mass and energy balance; Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries; Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Applied Process Design for Chemical and Petrochemical Plants, E.E. Ludwig, Butterworth-Heinemann
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann
- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling, F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design, E. Bausbacher and R. Hunt, Prentice Hall PTR.

ARTIFICIAL NEURAL NETWORKS

Course Code: BTB 710 **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, beides the closely related aspects of artificial neural networks.

Course Contents:

Module I

Historical background, Why is learning hard?

Module II

Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multi-layer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning,

Module III

The backpropagation algorithm, Aspects of Learning Theory and Generlization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?

Module IV

Neural networks and analog VLSI, Selected Applications

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Neural Networks: A Comprehensive Foundation, S. Haykin, Prentice Hall
- Neutral Networks for Pattern Recognition, C. Bishop, Oxford University Press

RELATIONAL DATABASE MANAGEMENT SYSTEMS

Course Code: CSE 710 **Credit Unit: 03**

Course Objective:

The objective of this course is to get students familiar with Databases and their use. They can identify different types of available database model, concurrency techniques and new applications of the RDBMS.

Course Contents:

Module I: Introduction:

Concept and goals of DBMS, Database Languages, Database Users, Database Abstraction.

Basic Concepts of ER Model, Relationship sets, Keys, Mapping, Design of ER Model, Concept of Generalization, Aggregation and Specialization. transforming ER diagram into the tables. Various data models.

Module II: Relational Data models:

Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages: SQL-DDL, DML, integrity constraints, Complex queries, various joins, indexing, Relational algebra and relational calculus, Relational algebra operations like select, Project, Join, Division, outer union.

Module III: Relational Data Base Design:

Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and lossless join, problems with null valued and dangling tuples, multivalued dependencies.

Module IV: Transaction Processing Concepts:

Transaction System, Serializability of schedules, recoverability, Checkpoint,s Concurrency Control Techniques: – Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation-based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction.

Module V: Trends in RDBMS:

Overview of Physical Storage Media, RAID, File Organization, Organization of Records in Files, Indexing and Hashing, Ordered Indices, Spatial and multimedia databases, Mobile and web databases

Course Outcomes:

The student will learn

- Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
- Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
- Learn and apply Structured query language (SQL) for database definition and database manipulation.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test, S/V/Q/HA: Seminar/Viva/Quiz/ Home Assignment, ESE: End Semester Examination.

Text & References:

Text:

- Korth, Silberschatz, “Database System Concepts”, 4th Ed., TMH, 2000.
- Steve Bobrowski, “Oracle & Architecture”, TMH, 2000

References:

- Date C. J., “An Introduction to Database Systems”, 7th Ed., Narosa Publishing, 2004
- Elmsari and Navathe, “Fundamentals of Database Systems”, 4th Ed., A. Wesley, 2004
- Ullman J. D., “Principles of Database Systems”, 2nd Ed., Galgotia Publications, 1999.

BIOPROCESS TECHNOLOGY LAB

Course Code: BTB 720 **Credit Units: 01**

Course Contents:

Module I
Isolation of industrially important micro organisms for microbial processes.

Module II
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer

Module III
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module IV
Comparative studies of ethanol production using different substrates.

Module V
Production of single cell protein

Module VI
Production and estimation of alkaline protease

Module VII
Sauer Krant fermentation

Module VIII
Use of alginate for cell immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

DOWNSTREAM PROCESSING LAB

Course Code: BTB 721 **Credit Units: 01**

Course Objective:

The laboratory will help the students to extract different bioproducts during their characterization since any of these products may be of biotechnological importance. They can be exploited in exploring the future biotechnology.

Course Contents:

Module I
Conventional filtration and membrane based filtration

Module II
Protein precipitation and recovery

Module III
Aqueous two-phase separation

Module IV
Ion exchange chromatography

Module V
Gel Permeation chromatography

Module VI
Electrophoresis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Text & References:

Text:

- Practical Biochemistry, Sawhney and Singh

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB

Course Code: CSE 730 **Credit Unit: 01**
Software Required: Oracle and MySQL

Topics covered in lab will include the following Programs: (02 Hours)

1. Using create command design three specific table and the table structure is given below.
   Table name- Book

ISBN	TITLE	PUB_YEAR	UNIT_PRICE	AUTHOR_NAME	PUB_NAME
1001	Oracle	2004	399	Arora	phi
1002	Dbms	2004	400	Basu	technical
2001	Dos	2003	250	Sinha	nirali
2002	Adbms	2004	450	Basu	technical
2003	Unix	2000	300	Kapoor	scitech

Table name- Author

AUTHOR_NAME	COUNTRY
Arora	U.S.A
Kapoor	Canada
Basu	India
Sinha	India

Table name- Publisher

PUB_NAME	PUB_ADD1
Phi	Delhi
Technical	Pune mainmarket
Nirali	Mumbai
Scitech	Chennai

2. Write the SQL query to find the name of all publisher from Book relation. **(02 Hours)**
3. Write the SQL query to display the name of all publisher using distinct clause.**(02 Hours)**
4. Write the SQL query to find the names of author from the author table where the first two characters of names are ‘ba’.**(02 Hours)**
5. Write the SQL query to display title of books published in year 2004.**(02 Hours)**
6. Write the SQL query to display title of books having price between 300 to 400.**(01 Hour)**
7. Write the SQL query to display title of books having price between 300 to 400 using operators.**(01 Hour)**
8. Write the SQL query to display title of books with author_name and country published in year 2004.**(01 Hour)**
9. Write the SQL query to display all title and (unit_price*10) as an attribute from book table using arithmetic expression.**(01 Hour)**
10. Write the SQL query to add the new column in all three tables.**(01 Hour)**
11. Study the concept of Views and their utility in DBMS ,write the SQL query to design a view.**(01 Hour)**
12. Write the SQL query to make the attribute ISBN as a primary key in Book relation.**(01 Hour)**
13. Write the SQL query to display the all the titles of Books with price and year in descending order.**(01 Hour)**
14. Write the SQL query to study the use of Delete and Drop command in DBMS. **(01 Hour)**
15. Study the concept of Triggers, cursors and stored procedures in DBMS. **(01 Hour)**

Course Outcomes:

- At the end of lab session students would be able to design the Database application for the real life projects.
- Students would be able to perform insertion, deletion and updation operation on Databases.

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

Note: IA –InternalAssessment, EE- External Exam, A- Attendance, PR- Performance, LR – Lab Record, V – Viva.

SUMMER PROJECT - II

Course Code: BTB 760 Credit Units: 06

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various biotechnological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/Research aspects of commercialization of biotechnological systems.
The students will be supervised by the internal faculty during the tenure of training.
The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report.
(Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**
- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

GENOMIC AND PROTEOMICS

Course Code: BTB 801 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic system has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamentals of genomics and Proteomics.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand the basic concept of evolution of genome in prokaryotes and eukaryotes
- Understand the concept of structural organization of genome and annotation. .
- Know the functional genes or coding genome and the understanding of functional genomics.
- Understand concept of biogenesis of RNAi, molecular markers and their application.
- Understand the various aspects of proteomics and protein identification.

Course Contents:

GENOMICS

Module I: Genome Evolution

Origin of genomes, Acquisition of new genes, DNA sequencing – chemical and enzymatic methods, The origins of introns, Genetics to genomics to functional genomics. Forward genetics (Phenotype to gene structure) and Reverse genetics (Gene structure to phenotype).

Module II: Structural Genomics

Chromosome structure and Genome organization, Genome assembly, Gene identification methods, Sequences Comparison Techniques, Genome annotation techniques.

Module III: Comparative Genomics

Phylogeny, COGS [Cluster of orthologues genes], paralogues and gene displacement, Metabolic Reconstruction, The Basic Principles and Methodology.

Module IV: Functional Genomics

ESTs, SAGE, cDNA Microarrays, Oligonucleotide Microarray Chips, Cancer and genomic microarrays, Application of Microarrays with examples, Microarray Data Analysis; Real Time PCR; Gene finding tools

Module V: Genotyping Background and Applications.

Genetic and physical mapping: Introduction to molecular markers-RFLP, RAPD, AFLP, SSRs and others. Genetic and physical maps, map based cloning, mapping population, southern and *in situ* hybridization for genome analysis, DNA fingerprinting; Single nucleotide polymorphisms, RNA interference, antisense RNA, siRNA, MiRNA, ; Human Genome Project; Pharmacogenomics: Ethical considerations of genetic testing; Genomics in drug discovery.

PROTEOMICS

Module VI: Fundamentals of Proteomics

Proteomics Basics and 2D Gel Electrophoresis,

Protein Identification and Analysis:

a. Protein preparation and Separationb. Protein Identification by mass spectrometryc. Identification of post translation modification

Protein Expression Mapping,High-throughput cloning of ORFs,Protein Protein Interaction Mapping: Experimental and Computational. Its application in health and disease.

Microarray - the technique, Experimental design & mass spectrometric data analysis, Application of Microarray in proteome analysis, Proteins Arrays and Protein Chips, Proteomics Tools and Databases

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: A practical guide to the analysis of genes and proteins, A.D. Baxevanis and B.F.F. Ouellette, John Wiley and Sons Inc.
- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Microarrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- Biotechnology and Genomics by P.K.Gupta

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology : Principles and Practice, Arthur M. Lesk
- DNA : Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Functional Genomics – A Practical Approach, S.P. Hunt and R. Livesey, Oxford University Press
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

DRUG DELIVERY SYSTEMS

Course Code: BTB 802 **Credit Units: 03**

Course Objective:

The course helps the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes:

After successful completion of the course student will be able to:

- Understand concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture (1-2), Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles)

Module III: Drug administration

Parenteral delivery – intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery through oral route – Structure and physiology of Gastro Intestinal tract, Impedements against oral availability, Advantages and disadvantages of oral drug delivery.

Current technologies and new and emerging technologies in oral delivery

Nasal and pulmonary delivery, Opthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS – Blood – Brain barrier, physiological and physiochemical factors for delivering to CNS, current and new technologies in CNS delivery

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of gene therapy and antisense therapy

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchips and controlled drug delivery, Genetically engineered cell implants in drug deliver.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

MANAGEMENT ACCOUNTING AND COST CONTROL

Course Code: BCH 621 **Credit Units: 01**

Course Objective:

The course aims to develop an understanding of the importance, language and techniques of Financial, Cost and Management accounting, skills for preparation and analysis of financial statements to enhance management planning and control, cost classification, allocation and how the costing techniques are useful in the process of managerial decision-making. Student should be able to understand the basic concepts of Company accounts with reference to the Indian context.

Course Contents:

Module I

Relevance of management accounting, Difference between management, financial and cost accounting, Basics concepts of accounting, financial statements

Module II

Cost accounting fundamentals, cost behaviour / classification, cost volume profit analysis, cost allocation, overhead application

Module III

Variable and Absorption costing, Job-Costing and Process-Costing Systems,

Module IV

Tools for planning and control, Master budget, Flexible Budgets and Variance analysis

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cost Accounting, C.Horngreen, Prenctice Hall
- Cost and Managerial Accounting, J.O. Cherrington, E.D. Hubbard and D.H. Luthy, WCB Publications.

References:

- Management Accounting, C. Horngreen, Prenctice Hall

PROJECT MANAGEMENT

Course Code: BCH 622 **Credit Units: 01**

Course Objective:

The course aims atmaking an understanding of the tools and the framework necessary to build a cohesive workflow plan that will help develop industry-standard process. Students will also learn project management skills specifically to all design and redesign projects, from the simplest to the most complex

Course Contents:

Module I: Introduction
Conceiving a project, Strategic Management and Project Selection, Work Breakdown Structure

Module II: Project Training
Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Project in Contemporary Organizations.

Module III: Project initiation
Project implementation– Scheduling, Resource Allocation, Monitoring and Information, Project Control

Module IV: Managing Risk
Risk Management Process: Risk Identification, Risk Assessment.
Risk Response Development: Risk Response Control

Module V: Project Termination
Project Auditing and Termination

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Project Management: A Managerial Approach, J.P. Meredith and S.J. Mantel, John Wiley and Sons Inc.

References:

- Project Management: The Managerial Process, Clifford F. Gray and Erik W. Larson

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.
The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I
Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II
Formal and informal organization, Performance appraisal, Training and development.

Module III
Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV
Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:
- The Practice of Management, P. Drucker, Harper Business.

ASP .NET

Course Code: CSE 804 **Credit Units: 03**
Total Hours: 30
Course Objective:
To create web based applications using ASP.NET and c#. Learns to create window based applications

Course Contents:

Module I: Introduction to .NET technologies (6 Hours)
Features of .NET, .NET Framework, CLR, MSIL, .NET class library, .NET Languages, CTS, assemblies, manifest, and metadata, What is ASP.NET?, Difference between ASP and ASP.NET.

Module II: Controls in ASP.NET (6 Hours)
Overview of Dynamic Web page, Understanding ASP.NET Controls, Applications, Web servers, Installation of IIS. Web forms, web form controls -server controls, client controls. Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box. Adding controls at runtime. Running a web Application, creating a multiform web project. Form Validation: Client side validation, server Side validation, validation Controls: Required Field Comparison Range. Calendarcontrol, Ad rotator Control, Internet Explorer Control.

Module III: Overview of ADO.NET and XML(8 Hours)
What is ADO.NET, from ADO to ADO.NET. ADO.NET architecture, Accessing Data using Data Adapters and Datasets , using Command & Data Reader, binding data to data bind Controls, displaying data in data grid, XML basics, attributes, fundamental XML classes: Document, text writer, text reader. XML validations, XML in ADO.NET, The XML Data Document.

Module IV: ASP.NET Applications(6 Hours)
Creating, tracking, caching, error handling, Securing ASP.NET applications- form based applications, window based application.

Module V: Web services(4 Hours)
Introduction, State management- View state, Session state, Application state, Building ASP.NET web services, working with ASP.NET applications, creating custom controls.

Course Outcomes:
The student will learn
- Develop dynamic web applications, create and consume web services
- Use appropriate data sources and data bindings in ASP.NET web applications
- Research and discover information about current topics, illustrate in an example, and present to the class.

Examination Scheme:

Components	A	CT	S/V/Q	HA	ESE
Weightage (%)	5	10	8	7	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

Text:
- ASP.NET Unleashed by Stephen Walther, SAMS publications

References:
- ASP.NET, Wrox Publications
- ASP.NET and VB.NET, Wrox Publication
- ASP.NET and C#.NET, Wrox publication.

GENOMICS AND PROTEOMICS LAB

Course structure: Genomics and Proteomics Lab **BTB 820**
Course Title: Genomics and Proteomics Lab **Credit Units: 01**
Course Level: UG Level **Course Code: BTB 820**

Course Objectives:
The course aims to develop competency and hand on expertise in the Genomics and Proteomics methods and applications.

Course Contents/Syllabus:

	Weightage (%)
Module I Three dimensional Structures – In silico study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins	15%
Module II: DNA sequencing method: Method to find out the unknown DNA sequence by Sanger sequencing	15%
Module III : Gene finding tools and Genome annotation	10%
Module IV : Comparison of two given genomes	10%
Module V : Analysis of 2D – IEF data	10%
Module VI : Microarray and Microarray data analysis	10%
Module VII : Inference of protein function from structure	10%
Module VIII : Inference of protein function and structure	10%
Module IX: Two-hybrid methods	10%

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Fundamental practical knowledge of basic and advance Genomic and proteomics techniques and experiments.

Pedagogy for Course Delivery: Laboratory instructions methodology discussion of experiment, Hands on experiment performance, data collection and analysis.

List of Professional Skill Development Activities (PSDA): NA

Lab/ Practical details:

Assessment/ Examination Scheme:

IA			**EE**			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Text & References:
Lab Manual

ASP.NET LAB

Course Code: CSE 824 **Credit Units: 01**
Total Hours: 20

Course Objective:
This course is designed to provide the knowledge of Dot Net Frameworks along with C#

Software Required: Visual Studio and SQL server
Topics covered in lab will include the following Programs:

- Write a program to display a feedback form. The different options for the list box must be ASP-XML, DotNET, JavaPro and UNIX, C, C++. When the Submit Form button is clicked after entering the data, a message must be displayed.
- Write a simple ASP.NET program to display the following Web Controls:

1. A button with text "clicks me". The button control must be in the center of the form.
2. A label with a text hello.
3. A checkbox.

- The form name must be Web Controls
- Write a program to display "Welcome To Radiant" in the form when the "click" button is clicked. The form title must be ASP.NET.

IV. Write a program that displays a button in green color and it should change into yellow when the mouse moves over it.

- Write a program containing the following controls:

1. A ListBox
2. A Button
3. An Image
4. A Label

The listbox is used to list items available in a store. When the user clicks on an item in the listbox, its image is displayed in the image control. When the user clicks the button, the cost of the selected item is displayed in the control.

VI. Write a program to get a user input such as the boiling point of water and test it to the appropriate value using CompareValidator.

VII. Write a program that uses a textbox for a user input name and validate it for RequiredField Validation.

VIII. Write a program that gets user input such as the user name, mode of payment, appropriate credit card. After the user enters the appropriate values the Validation button must validates the values entered.

IX. Declare one TextBox control, one Button control, one Label control, and one RegularExpressionValidator control in an .aspx file. The submit() function checks if the page is valid. If it is valid, it returns "The page is valid!" in the Label control. If it is not valid, it returns "The page is not valid!" in the Label control. If validation fails, the text "The zip code must be 5 numeric digits!" will be displayed in the RegularExpressionValidator control.

X. Check the length of the string in the TextBox using CustomValidator.

Course Outcomes:
After completion of the course the student will be able to use the features of Dot Net Framework along with the features of C#

Examination Scheme:

IA				EE	
A	**PR**	**LR**	**V**	**PR**	**V**
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

MAJOR PROJECT

Course Code: BTB 860 **Credit Units: 16**

Course Objective:

The students are expected to utilize their scheduled periods by undertaking the project that would be completed during the semester

Every student shall undertake a major Project. The major Project shall be undertaken in some biotechnology industry or laboratory of repute. Each student shall be assigned to a faculty who shall continuously monitor the progress of the Project in the concerned laboratory or industry. The faculty, in consultation with the concerned scientist of the industry/laboratory, shall decide the topic of the project. At the conclusion of the project the student shall submit a seminar and a dissertation. The dissertation shall be evaluated by the internal faculty/examiner. The student then shall have to appear for the viva voce axamination.

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 **Abstract** and **Keywords**

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

➢ Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

➢ Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

➢ Abstract

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

➢ Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

➢ Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➢ Review of Literature and Definition of Problem

➢ Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➢ Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➢ Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

➢ Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➢ Summary

➢ Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➢ References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	100
Viva Voce:	100
Total:	**200**

AMITY UNIVERSITY

MADHYA PRADESH

Bachelor of Science (Honours) Biotechnology

Programme Code: BSB

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2021 -2024

AMITY UNIVERSITY

MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2021

PROGRAMME OBJECTIVE

B. Sc. (H) Biotechnology aims to develop highly specialized hard core specialization in various diversified areas of biotechnology and its application to medicine, agriculture, environment, nutraceuticals and functional food etc.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research orientated project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practical conducted in well equipped laboratories in the area of Biotechnology, Animal Biotechnology & Immunology. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biotechnology.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses:						
BSB 101	Cell Biology	3	-	-	3	
BSB 102	Maths & Biostatistics	3	-	-	3	
BSB 103	Plant Sciences – I	3	-	-	3	
BSB 104	Animal Sciences-I	3			3	
BSB 105	Chemistry – I	3	-	-	3	
BSB 120	Biotechnology Lab - I	-	-	2	1	
BSB 121	Chemistry Lab – I	-	-	2	1	
BSB 122	Plant Sciences Lab - I	-	-	2	1	
BSB 123	Animal Sciences Lab-I			2	1	
EVS 142	Environmental Studies - I	2	-	-	2	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 141	Communication Skill - I	30	-	-		
BSU 143	Behavioural Science - I	30	-	-		
 FLU 144 FLU 145 FLU 146 FLU 147 FLU 148	Foreign Language - I French - I German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses:						
BSB 201	Introductory Biochemistry & Biophysics	3	1	-	4	
BSB 202	Bioanalytical Techniques	3	-	-	3	
BSB 203	Plant Sciences – II	3	-	-	3	
BSB 204	Animal Sciences-II	2	1		3	
BSB 205	Chemistry – II	3	-	-	3	
BSB 220	Biotechnology Lab – II	-	-	2	1	
BSB 221	Chemistry Lab – II	-	-	2	1	
BSB 222	Plant Sciences Lab – II	-	-	2	1	
BSB 223	Animal Sciences Lab-II	-	-	2	1	
EVS 242	Environmental Studies - II	2	-	-	2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 241	Communication Skill - II	30	-	-		
BSU243	Behavioural Science - II	30	-	-		
 FLU 244 FLU 245 FLU 246 FLU 247 FLU 248	Foreign Language - II French - II German Spanish Japanese Chinese	30	-	-		

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

BSB 301	Genetics	3	-	-	3	
BSB 302	Microbiology	4	-	-	4	
BSB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BSB 304	Anatomy & Plant Physiology	3	-	-	3	
BSB 305	Animal Physiology-I	2	1	-	3	
BSB 306	Chemistry – III	3	-	-	3	
BSB 320	Biotechnology Lab – III	-	-	4	2	
BSB 321	Chemistry Lab – III	-	-	2	1	
BSB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BSB 323	Animal Physiology Lab-I	-		2	1	
BSB 330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**26**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 341	Communication Skill - III	30	-	-		
BSU343	Behavioural Science - III	30	-	-		
	Foreign Language - III	30	-	-		
FLU 344	French - III					
FLU 345	German					
FLU 346	Spanish					
FLU 347	Japanese					
FLU 348	Chinese					

TERM PAPER: 4 – 6 WEEKS

FOURTH SEMESTER

Compulsory Courses:						
BSB 401	Bioinformatics	3	-	-	3	
BSB 402	Molecular Cell Biology	3	-	-	3	
BSB 403	Immunology & Immunotechnology	3	-	-	3	
BSB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BSB 405	Animal Physiology-II	3	-	-	3	
BSB 406	Chemistry – IV	3	-	-	3	
BSB 420	Biotechnology Lab - IV	-	-	4	2	
BSB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BSB 422	Animal Physiology Lab-II	-	-	2	1	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 441	Communication Skill - IV	30	-	-		
BSU443	Behavioural Science - IV	30	-	-		
	Foreign Language - IV	30	-	-		
FLU 444	French - IV					
FLU 445	German					
FLU 446	Spanish					
FLU 447	Japanese					
FLU 448	Chinese					

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses:						
BSB 501	Plant Biotechnology	3	-	-	3	
BSB 502	Animal Biotechnology	3	-	-	3	
BSB 503	Genomics & Proteomics	3	-	-	3	
BSB 504	Recombinant DNA Technology	3	-	-	3	
BSB 520	Biotechnology Lab - V	-	-	4	2	
BSB 521	Genomics & Proteomics Lab	-	-	4	2	
BSB 550	Summer Training (Evaluation)	-	-	-	5	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 541	Communication Skill - V	30	-	-		
BSU 543	Behavioural Science - V	30	-	-		
	Foreign Language - V	30	-	-		
FLU 544	French - V					
FLU 545	German					
FLU 546	Spanish					
FLU 547	Japanese					
FLU 548	Chinese					

SIXTH SEMESTER

Compulsory Courses:						
BSB 601	Environmental Biotechnology	4	-	-	4	
BSB 602	Industrial Biology	4	-	-	4	
BCH 623	Principles of Management & Entrepreneurship Development	1	-	-	1	
BSB 620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BSB 660	Project (10-12 Week)	-	-	-	12	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCU 641	Communication Skill - VI	30	-	-		
BSU 643	Behavioural Science - VI	30	-	-		
	Foreign Language -VI	30	-	-		
FLU 644	French - VI					
FLU 645	German					
FLU 646	Spanish					
FLU 647	Japanese					
FLU 648	Chinese					

CELL BIOLOGY

Course Code: BSB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the theories given by scientists for the origin of cell along with different types of prokaryotic and eukaryotic cells.
- Know the cellular structure of cell organelle and their functions.
- Differentiate between chromosomal structures in different stages of a cell cycle.
- Understand towards cell differentiation, malignancy and cell death.
- Develop verbal and written skills of subject along with interdisciplinary approach.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology -Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker ,Klinshmith& Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: BSB 102 **Credit Units: 03**

Course Objective:

The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course
Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II
Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III
Measure of central tendency and measure of dispersion
Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution
Simple problems involving Binomial, Poisson and Normal variables,

Module IV
Correlation and regression,
Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:
- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: BSB 103 **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Learning Outcome

1. The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways & mode of reproduction.
2. Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans.
3. Study and acquire knowledge about the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza.
4. Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes.

Course Contents:

Module I: Algae
Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi
Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:,*Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes
Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella*, *Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: BSB 104 **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Learning Outcome

After successful completion of the course student will be able to:

- Learn about characteristics and variations of invertebrates.
- Develop scientific outlook for research and innovation.
- Get knowledge of typical invertebrates and their economic importance.
- Develop conservative outlook for animals.
- Generate written and verbal communication skills over the subject.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.

-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:

-Protozoa: Type study of *Plasmodium.*

-Porifera: Type of *Sycon.*

Module III

-Coelnterata: Type study of *Ovelia.*

-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates

-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*

-Arthropoda: Type Study of *Prawn*

Module V:

Mollusca: Type Study of *Pila*

Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: BSB 105 **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd**.**
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: BSB 120 **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: BSB 121 **Credit Units: 01**

Course Contents:
INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2Cr_2O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Plant Sciences Lab - I

Course Code: BSB 122 **Credit Units: 01**

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Sciences Lab- I

Course Code: BSB 123 **Credit Units: 01**

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	
	Assessment/ Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha, Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest,

water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**ESE**
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

This course aims at imparting an understanding of:

- Understanding self & process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and its effective on personality
- Building Emotional Competency

Course Contents:

Module I: Self: Core Competency **(2 Hours)**

- Understanding of Self
- Components of Self – Self identity
- Self concept
- Self confidence
- Self image

Module II: Techniques of Self Awareness **(2 Hours)**

- Exploration through Johari Window
- Mapping the key characteristics of self
- Framing a charter for self
- Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness **(2 Hours)**

- Meaning
- Importance
- Components of self esteem
- High and low self esteem
- Measuring your self esteem

Module IV: Building Positive Attitude **(2 Hours)**

- Meaning and nature of attitude
- Components and Types of attitude
- Importance and relevance of attitude

Module V: Building Emotional Competence **(2 Hours)**

- Emotional Intelligence – Meaning, components, Importance and Relevance
- Positive and negative emotions
- Healthy and Unhealthy expression of emotions

Student learning outcomes

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-I

CourseCode: FLU144 **Creditunits: 02**

CourseObjective:
Tofamiliarize studentswiththeFrenchlanguage,withitsphonetic systemanditsaccents.
Toenable students

- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone'sfamily,tastes andpreferences

CourseContents:
Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:
S'adresserpolimentàquelqu'un,entrerencontact,seprésenter,présenterquelqu'un,saluer,poserdesquestions
simplespourconnaître quelqu'un,épeleret compter
Dossier2:EnfamilleActesdeCommunication:
Parler de sa famille, Décrire quelqu'un, exprimer ses goûts, écrire et comprendre un message court, inviter
quelqu'un,exprimerla possession,la négation
Grammaire :
1. articles indéfinis,articlesdéfinis, masculinetfémininдesnomset desadjectifs,pluriel desnomset desadjectifs
2. pronomssujetsettoniques,on,c'est/il est+ profession,
3.masculinet fémininдesadjectifsdenationalité
4. verbes-être,avoir,aller,'er'groupe
5. l'interrogation–l'intonation,est-ce que,quiest-ce ? Qu'est-ce que? L'inversion; où,comment,quand; quel
6. la négation
7. adjectifspossessifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BSB 201 **Credit Units: 04**

Course Objective:

Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Learning Outcome:

After successful completion of the course student will be able to:

* Get familiarize with structures and functions of biomolecules like Carbohydrates, Fats and Nucleic Acids.
* Understand the role of covalent and non-covalent bonds, inter-and intramolecular interactions and their contribution to the native conformation of biomolecules.
* Know the molecular transport within the cell and across membranes and get familiar with the different laws of Physics that are valid in biological systems.
* Calculate energy changes in biological pathways, understand mechanism of light and sound reception.
* Understand how electricity can act as potent signal as well the role of neurotransmitters.

Course Contents:

Module I: Nature of Biological materials
carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules
Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic
Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body
Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments
Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:
- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry -Voet&Voit

BIOANALYTICAL TECHNIQUES

Course Code: BSB 202 **Credit Units: 03**

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the principle and instrumentation of Colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, etc.
- Understand principle instrumentation of chromatographic techniques and their types.
- Principle and applications of electrophoresis I.e., PAGE, Immunoelectrophoresis etc.
- Understand radioisotope tracer techniques and application.
- Develop broad knowledge base, deep theoretical understanding of instruments and their practical implementation in the laboratory

Course Contents:

Module I: Instruments, basic principles and usage
pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques
Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis
Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

PLANT SCIENCES - II

Course Code: BSB 203 **Credit Units: 03**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Learning Outcomes:

1. The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm.
2. The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms.
3. The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms.
4. Know the economic importance of the angiosperm plants.
5. Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma*.

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas*, *Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

ANIMAL SCIENCES-II

Course Code: BSB 204 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge about Chordates.
- Learn about comparative account of vertebrates.
- Learn about anatomical & physiological variability among vertebrates.
- Generates interdisciplinary and collaborative approach.
- Develops ethical and conservative outlook for animals.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: BSB 205 **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I

Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II

Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III

Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV

Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V

Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India.

BIOTECHNOLOGY LAB – II (BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: BSB 220 **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BSB 221 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following:
Pb^{2+}, Hg^{2+}, Hg^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^{1+}, K^{1+}, CO_3^{2-}, S^{2-}, SO_3^{2-}, NO_2^{1-}, CH_3COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO_3^{1-}, SO_4^{2-}, $C_2O_4^{2-}$, PO_4^{3-}, BO^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: BSB 222 **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations**.**

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: BSB 223 **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear Different types of important edible fishes of India .Study of specimens and slides related to Chordates should be added

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*
Alan Pease : Body Language

Additional Reading: **Newspapers and Journals**

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**
Total Hours: 10

Course Objective:

This course aims at enabling students towards:

- Understand the importance of individual differences
- Better understanding of self in relation to society and nation
- Facilitation for a meaningful existence and adjustment in society
- Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

- Personality: Definition& Relevance
- Importance of nature & nurture in Personality Development
- Importance and Recognition of Individual differences in Personality
- Accepting and Managing Individual differences
- Intuition, Judgment, Perception & Sensation (MBTI)
- BIG5 Factors

Module II: Managing Diversity

- Defining Diversity
- Affirmation Action and Managing Diversity **(2 Hours)**
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

Module III: Socialization **(2 Hours)**

- Nature of Socialization
- Social Interaction
- Interaction of Socialization Process
- Contributions to Society and Nation

Module IV: Patriotism and National Pride **(2 Hours)**

- Sense of pride and patriotism
- Importance of discipline and hard work
- Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

- Meaning and Importance of human rights
- Human rights awareness
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

▪Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions

▪Student will be able to understand and respect individual difference, so to enhance the relationship ▪Learn social responsibility and develop a sense of citizenship

▪Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

•Davis, K. Organizational Behaviour,
•Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour
•Dressler, David and Cans, Donald: The Study of Human Interaction
.•Lapiere, Richard. T – Social Change
•Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
•Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. Robbins O.B.Stephen;.
Organizational Behaviou

Français-II

CourseCode: FLU244 **Creditunits: 02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

CourseContents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:
Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessportsetdes loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:
Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,comparereet exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

GENETICS

Course Code: BSB 301 **Credit Units: 03**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the concept of classical genetics including Mendelian laws is easily grasped by students.
- Understand the basic microbial genetics including prokaryotic gene expression and regulation.
- Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept.
- Know various chemical and physical mutagens involved in causing mutation.
- Understand the concept of sex determination and populations genetics.

Course Contents:

Module I

Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II

Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV

Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V

Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI

Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII

Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: BSB 302 **Credit Units: 04**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the microbiological techniques for the isolation and characterization of microbes.
- **Understand the mechanism of different metabolic processes.**
- Know the physiology and survival mechanism of extremophilic bacteria.
- Know the concept of virus lytic and lysogenic cycle is quite clear to students.
- **Understand the epidemiology and microbial pathogenesis.**

Course Contents:

Module I

Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization,

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: BSB 303 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge of biochemical aspects of body.
- Learn about important metabolic pathways and their regulation.
- Deals with pathways responsible for energy production.
- Study of various enzymatic reactions and their role in body.
- Develops collaborative and research approach.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing.

ANATOMY & PLANT PHYSIOLOGY

Course Code: BSB 304 **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Learning Outcomes:
1. The students will be conceptually integrated to plant internal structure & their functions
2. Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants.
3. The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation.
4. The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students.
5. The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.

Course Contents:

Module I
Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviourof cambium in *Achyranthes, Boerhaavia, Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II
Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III
Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV
Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:

- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: BSB 305 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Gain knowledge about functioning of systems of body.
- Generate path for further research and innovation.
- Enhance new collaborative approaches with modern fields of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSB 306 **Credit Units: 03**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3^{rd} elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III

Course Code: BSB 320 **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation

Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human

Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.

Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.

Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BSB 321 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO^{2+} as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BSB 322 **Credit Units: 01**

Course Contents:

Module I: Physiology

Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.

Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.

Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)

Experimentation- Separations of photosynthetic pigments by thin layer chromatography.

Respiration – Determination of R.Q.

Module II: Plant Anatomy

Anatomy of normal dicot and monocot roots, stems & leaves

Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSB 323 **Credit Units: 01**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Principles of Effective Writing** • Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	**35%Weightage**
2.	**Module II Formal Letter Writing** • Block Format • Types of Letters • E-mail • Netiquette	**35% Weightage**
3.	**Module III Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV Short Stories** • Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	**10%Weightage**
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.***

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: ***Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.***

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:
To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:
Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
- Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998.
- Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:
Toenablethe students
- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:
Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:
Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.
Dossier6:AilleursActesdeCommunication:
S'exprimeraupassécomposé,raconterunvoyage,
sesituerdanslemonde,exprimerletemps(avecindicateursde
temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.
Grammaire :
1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:
Le livre àsuivre:

- Andant,Christineet al.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.<u>Réussirle DELFA1.</u>

TERM PAPER

Course Code: BSB 330 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.
f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%
(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOINFORMATICS

Course Code: BSB 401 **Credit Units: 03**

Course Objective:
The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Learning Outcomes:
Having successfully completed this course, students will be able to:

- Understand and explain the structural organization and characteristics of computers and its parts.
- Describe the concept of use of internet in bioinformatics.
- Explain the concept and organization of biological databases.
- Understand and explain the structure and functions of the phylogenetic analytic tools.
- Interrogate major database sources and be able to integrate this information with clinical data.

Course Contents:

Module I: Computers
General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics
Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases
Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis
Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module V: Genome analysis
Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
Text:
- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:
- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: BSB 402 **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information's are stored, expressed and transmitted among generations.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop deep understanding of DNA/ RNA structure, and mechanism of DNA replication.
- Understand Genetic Codes and Transposable elements
- Understand mechanism of transcription and translation in prokaryotes and eukaryotes.
- Enhance fine molecular understanding of operon gene regulation ion in prokaryotes.
- Understand the mechanism of Oncogenes and Tumor suppressor genes.

Course Contents:

Module I: Introduction to Moleculer Biology,

Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.

Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.

Module II:Insertion elements, transposons and retrotransposons

Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.

Application of genetic engineering

Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes

Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.

Module III: Structure of prokaryotic and eukaryotic genes

Transcription mechanism in prokaryotes and eukaryotes.

Translation : Translation mechanisms in prokaryotes and eukaryotes.

Module IV: Gene Expression in prokaryotes

Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)

Module V:Eukaryotic geneExpression

Overview of gene expression, polyadenylation, cap formation, RNA degradation.

Module VI: Oncogenes and Tumor Suppressor genes

Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY & IMMUNOTECHNOLOGY

Course Title: **IMMUNOLOGY & IMMUNOTECHNOLOGY** Credit Units: 03
Course Level: UG Level Course Code: BSB 403
Course Objectives:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Course Contents/Syllabus:

	Weightage (%)
Module I :	
Historical perspective of immune system and immunity; Innate and specific immunity. Humoral immunity, Cell-mediated immunity and Clonal selection theory. The organs: Primary and secondary lymphoid organ. Hematopoiesis and regulation. Cells of the immune system: granulated and agranulated cells.	20 %
Module II:	
Histocompatibility: structure of MHC class I, II & III Antigens & their mode of antigen presentation MHC restriction. Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Genetic basis of antibody diversity. Antibodies in targeting therapeutic agents. Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application.	20 %
Module III :	
Measurement of antigen – antibody interaction: Affinity, Avidity, cross reactivity, Agglutination, Precipitation Immunodiffusion, Immuno-electrophoresis, ELISA, RIE, Western blotting, Fluorescent antibody techniques	20 %
Module IV :	
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination. Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma Hypersensitivity- type I, II, III, and IV hypersensitivity Tissue and organ transplantation	20 %
Module V :	
Immunoinformatics: Immunomics B cell and T cell databases. Webservers and tools for prediction of B-cell epitopes, T-cell epitopes, allergy and *in-silico* vaccine designing. Introduction of immunophysics techniques and applications.	20%

Student Learning Outcomes:
Having successfully completed this course, students will be able to:

- Understand and explain the phylogeny of immune system, types of immunity, immune response.
- Describe the concept of clonal selection theory, humoral and cell mediated immunity.
- Understand and explain the structure and functions of the organs and cells of the immune system.
- Understand the mechanism of antigen-antibody interaction.
- Describe the structure of antibodies, their types and functions in immunity.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Learning Outcomes:

1. The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view.
2. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation.
3. The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products.
4. The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them.
5. The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

Course Contents:

Module I

Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.

Module II

Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding

Module III

General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.

Module IV

Economic importance with special reference to plants yielding:

a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
b) Common fibre yielding plants - Cotton, Jute .
c) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
d) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BSB 405 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Understands functioning of important systems of body.
- Develops knowledge about endocrinology and developmental biology.
- Leads to enhance interest in research in advanced biotechnology.
- Exposure with other interdisciplinary subjects of biology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals

- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:

- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:

- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization
-

Module IV:Developmental Biology:

- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: BSB 406 **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic &non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates

Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II

General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III

General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV

Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics

Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry

Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry

Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY LAB – IV

Course Title: BIOTECHNOLOGY – IV LAB **Credit Units: 02**
Course Level: UG **Course Code: BSB 420**

Course Contents/Syllabus:

	Weightage (%)
Module I: Computers	25%
Handling of computers and Protein and nucleotide sequence retrieval and analysis using different databases	
Module II: Bioinformatics	25%
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.	
Module III	25%
Isolation of nuclear DNA (genomic & plasmid DNA) and Agarose gel electrophoresis	
Module IV	25%
Blood film preparation &identification of blood cells Study of blood groups Study of ELISA.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection
List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSB 421 **Credit Units: 01**

Course Contents:

Module I: Embryology
Study of permanent slides of the**:**
a) T.S. anther, pollen, germinating pollen
b) L.S. ovule types
c) Endosperm
d) Embryos
e) L.S. caryopsis
f) Dissection of embryo

Module II:Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code: BSB 422 **Credit Units: 01**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland
- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.
- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • “The Lottery” 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: *Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: *Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.*
Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building-"New Self awareness.

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.
Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulotActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

1. l’imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant, Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.

· Andant, Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:

· Girardeau, Brunoet NellyMous.Réussirle DELFA1

PLANT BIOTECHNOLOGY

Course Code: BSB 501 **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation.

Learning outcomes:

After successful completion of the course student will be able to:

- Handle the basic instruments used in plant biotechnology.
- Learn Preparation of stocks for culture media.
- Learn surface sterilization of different explants
- Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab.
- Get training of problems related to germination, callus induction and propagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Title: ANIMAL BIOTECHNOLOGY **Credit Units: 3**
Course Level: UG Level **Course Code: BSB-502**

Course Objectives:
The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering. Cell-culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures.	
Module II	15%
In-Vitro Fertilization (IVF) and Embryo Transfer Technology (ETT).	
Module III	20%
Somatic cell hybridization, Hybridoma technology and Production of Monoclonal antibodies.	
Module IV	20%
Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer, Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc. Bioethical issues related to animal biotechnology.	
Module V	15%
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).	
Module VI	10%
Fundamentals of Stem cell based therapy, Regenerative medicines	

Student Learning Outcomes:

- Concepts of animal biotechnology and its commercial applicability
- Understand sterilization techniques, understanding of organ culture.
- Learn methods of animal cell culture and maintenance and immobilization techniques.
- Understand concepts in-vitro fertilization and embryo transfer for live stock improvement.
- Become familiar with concept of somatic hybridization and transgenic technology.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable
Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

GENOMICS& PROTEOMICS

Course Code: BSB 503 **Credit Units: 03**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Gain understanding of basic structure of protein and its separation by using various techniques.
- Get insight of modeling and *in silico* protein structure building.
- Get understanding of study of protein – protein interaction using various methods.

Course Contents:

GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome :2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BSB 504 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Learning Outcomes:

After successful completion of the course student will be able to:
* Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification.
* Know various methods of introducing DNA into living cells.
* Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells.
* Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy.
* Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

Course Contents:

Module I
Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II
Methods of DNA Introduction into living cells.

Module III
Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV
Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V
Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.
PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Gene cloning and DNA analysis by T.A. Brown

References:
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

BIOTECHNOLOGY LAB – V(BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BSB 520 **Credit Units: 02**

Course Contents:

Module I
Sterilization techniques of glass wares &equipments.
Preparation of cotton plugs & culture media .
Preparation and sterilization .of different explants.
Inoculation of explants on culture media.

Module II
Culture of plant embryos/seeds.Callus culture, Testing of seed viability.

Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

Module IV
Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD &*E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BSB 521 **Credit Units: 02**

Course Contents:

Module I
Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II
Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III
Comparison of two given genomes- Mummer.

Module IV
Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary** • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	**35% Weightage**
2.	**Module II Comprehension Skills** • Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	**25% Weightage**
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in Presentation Skills • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**
Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan
Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

_ narratingevents inthe past, markingthestages, usingappropriateconnectors
_ expressingcausesandconsequences, usingappropriate logical connectors
_ presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensembleActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement ,
l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

SUMMER TRAINING (EVALUATION)

Course Code: BSB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and software's, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

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All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

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- **Review of Literature and Definition of Problem**

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This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

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- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

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For research article

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For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

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BIBLIOGRAPHY/REFERENCES (16 bold, caps)

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ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BSB 601 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the delicate interrelationship of different components of environment.
- Understand conventional fuels, their impact and concept of clean fuel technology.
- Learn approaches and concepts behind bioremediation xenobiotic compounds, mechanism of microbial leaching and mining.
- Learn the concept of municipal solid and liquid wastes management and EIA.
- Understand the concept and assessment of environmental quality.

Course Contents:

Module I

Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II

Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III

Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV

Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V

Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code: BSB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Develop an understanding of the various aspects of Bioprocess Technology.
- Develop skills associated with screening of Industrially Important Strains and media formulation for industry.
- Understand principles underlying design of fermentor, fermentation process and downstream processing
- Develop an understanding of the various aspects of dairy Technology.
- Understand principles underlying immobilization and their application.

Course Contents:

Module I
Introduction to industrially important microbes, Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II
Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III
Microbial fermentative products, Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, food products from microbes (Dairy &SCP etc)
.

Module IV
Production of fermented dairy products

Module V
Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Industrial Microbiology – Cassida

References:

- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot &Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code: BSB 620 **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Social Communication Essentials**	**30% Weightage**
	• Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	
2.	**Module II Workplace Interpersonal Skills**	**25% Weightage**
	• Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose**	**10% Weightage**
	• Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Code: BSU-643 **Course Credit: 01**

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	1 0	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BSB 660 **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate’s name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

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Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

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Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Master of Science (Biotechnology)

Programme Code: MSB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2021 -2023

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.
This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.
The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.
July, 2021

PROGRAM OBJECTIVE

The objective of Masters Programme in Biotechnology of Amity University is to develop multifaceted academically excellent students in various areas of Biotechnology. The course also aims to enhance the knowledge gained by them in the undergraduate curriculum so as to make them competent for future, academic or industrial pursuits.
The subjects included in the course curriculum suffice for both fundamental and applied aspects of biotechnology. Each subject is adequately supported by applied practicals conducted in well-equipped laboratories. Subjects like Cell Biology, Genetics, Enzymology, Microbiology, Plant Biotechnology, Animal Biotechnology, and Immunology have contents with molecular approach so as to fulfill the requirements of current research and developmental needs. Industry oriented subjects like bioprocess engineering, downstream processing is taught for imparting knowledge of biotechnological application in industry.
In addition, molecular biology and recombinant DNA Technology is taught at advanced levels as they form the core foundation of biotechnology and biotechnological processes.

Therefore the present postgraduate curriculum in Biotechnology is aimed to produce highly motivated challenging young biotechnologist to take our country on the path of Biotechnology revolution.

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MSB101	Advanced Biochemistry	3	1	-	4	
MSB102	Advanced Microbial Technology	3	-	-	3	
MSB103	Biophysics & Bioanalytical Techniques	3	-	-	3	
MSB104	Advanced Cell Biology & Genetics	3	1	-	4	
MSB105	Advanced Biostatistics for Biologists	3	-	-	3	
CSE 103	Computer Applications	3	-	-	3	
MSB120	Biochemistry Lab	-	-	4	2	
MSB121	Advanced Microbial Technology Lab	-	-	2	1	
MSB122	Cell Biology & Genetics Lab	-	-	2	1	
CSE 123	Computer Applications Lab	-	-	2	1	
	TOTAL				**25**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP141	Advanced Communication - I	30	-	-		
BSP143	Behavioural Science - I	30	-	-		
 FLP144 FLP145 FLP146 FLP147 FLP148	Foreign Language - I French - I German Spanish Japanese Chinese	30	-	-		

SECOND SEMESTER

Compulsory Courses:						
MSB201	Advanced Molecular Biology	4	-	-	4	
MSB202	Advances in Genetic Engineering	4	-	-	4	
MSB203	Bioprocess Technology	4	-	-	4	
MSB204	Advanced Genomics & Proteomics	4	-	-	4	
MSB205	Computational Biology	3	-	-	3	
MSB206	Environmental Biotechnology	3	-	-	3	
MSB220	Advanced Molecular Biology Lab	-	-	4	2	
MSB221	Genetic Engineering Lab	-	-	4	2	
MSB222	Bioprocess Technology Lab	-	-	4	2	
MSB223	Advanced Genomics & Proteomics Lab			2	1	
MSB224	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP241	Advanced Communication - II	30	-	-		
BSP243	Behavioural Science - II	30	-	-		
 FLP244 FLP245 FLP246 FLP247 FLP248	Foreign Language - II French - II German Spanish Japanese Chinese	30	-	-		

SUMMER INTERNSHIP OF 09 -12 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MSB301	Advanced Immunology	3	-	-	3	
MSB302	Enzyme Technology	3	-	-	3	
MSB303	Advanced Animal Biotechnology	3	-	-	3	
MSB304	Advanced Plant Biotechnology	3	-	-	3	
 MSB305 MSB306 MSB307 MSB308 MSB309 MSB310 MSB311	**Elective (Select any One)** • Drug Design & Development • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
MSB320	Advanced Immunology Lab	-	-	2	1	
MSB321	Enzyme Technology Lab	-	-	2	1	
MSB322	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
MSB350	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**30**	

FOURTH SEMESTER

Compulsory Courses:						
MSB460	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

ADVANCED BIOCHEMISTRY

Course Code: MSB 101 **Credit Units: 04**

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn carbohydrate metabolism in detail by analyzing all the pathways.
- Learn the various aspects of lipid metabolism and their regulation.
- Understand the metabolism of Nitrogen and excretion of urea from body.
- Learn Nucleotide metabolism and clinical disorders of purine metabolism.
- Develop advanced knowledge of action of major hormones and principles and application of primary and secondary metabolites.

Course Contents:

Module I

Basics of structures of biopolymers; Carbohydrates, Lipids, Proteins and Nucleic Acids.

Module II

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module III: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module IV: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module V: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module VI: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VII: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper’s Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), LubertStryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: MSB 102 **Credit Units: 03**

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around us.
- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

Course Contents:

Module I:Introduction to microbiology

Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms

Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics

Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation.Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology

Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings.

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: MSB 103 **Credit Units: 03**

Course Objective:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Learning Outcomes

After successful completion of the course student will be able to:

- Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential.
- Learn about the radiation biophysics and its uses such as tracer techniques etc.
- Learn about various spectroscopic techniques and X –ray crystallography.
- Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein.
- Learn different chromatography and centrifugation techniques for separation of bio-molecules.

Course Contents:

Module I: Membrane Biophysics
Genesis of membrane potential in nerve & membrane, Nerst& Goldman equation, Patch Clamp and Voltage – Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.

***References*:**

- Bioinstrumentation, Webster.
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: MSB 104 **Credit Units: 04**

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporate elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Learning Outcomes:

After successful completion of the course student will be able to:

* Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations.
* Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles.
* Understand molecular mechanisms of how and why cells move?
* Understand the molecular structure and function of various receptors and mechanism of cell signalling.
* Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.
Extrachromosomal inheritance:,Mitocondrial and chloroplast genetic code
Chromosomal aberration and polyploidy
Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon &nutron) Benzer's work on r II locus in T_2 bacteriophage.
Population genetics- Hardy weinbergsselection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import
Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase,Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer**,** cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: MSB 105 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Learning Outcomes:

Upon course completion, students will be able to understand:

- Fundamental knowledge of basic statistical Techniques.
- Various Statistical Tools used in data presentation and interpretation
- Probability and various distributions.
- Formulation and testing of hypothesis
- Correlation & Regression analysis.
- Analysis of variance(ANOVA)
- Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

Course Contents:

Module I:Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III:Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand& Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: CSE 103 **Credit Units: 03**
Total hours: 30

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers (6 Hours)

Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office (5 Hours)

Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system (7 Hours)

Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce (5 Hours)

Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language (7 Hours)

Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF .. ELSE statements – Loopingconcepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Course Outcomes:

The student will learn

- Work effectively with a range of current, standard, Office Productivity software applications.
- Evaluate, select and use office productivity software appropriate to a given situation.
- Apply basic adult learning and assessment principles in the design, development, and presentation of material produced by office productivity applications.
- Demonstrate employability skills and a commitment to professionalism.
- Operate a variety of advanced spreadsheet, operating system and word processing functions.
- A basic idea of computer programs and its database.

Examination Scheme:

Components	**A**	**CT**	**S/V/Q/HA**	**ESE**
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/Home Assignment, ESE: End Semester Examination;

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj &Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: MSB 120 **Credit Units: 02**

Course Contents:

Module I: Proteins

Identification of protein by Biuret test.
Quantization of protein by Bradford method
Separation of proteins by SDS-PAGE

Module II: Enzyme

Enzyme activity study of serum alkaline phosphates.

Module III: Nucleic Acid

Biochemical estimation of DNA
Biochemical estimation of RNA
Separation of DNA on Arose gel.

Module IV: Carbohydrate

Biochemical estimation of blood sugar

Module V: Lipids

Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ADVANCED MICROBIAL TECHNOLOGY LAB

Course Code: MSB 121 **Credit Units: 01**

Course Contents:

Module I

Aseptic techniques: preparation of culture media for cultivation of specific microorganism.
Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II

Biochemical test - Indole test. methyl red test. vogesproskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III

Isolation of special microbes from environment by isolation and enrichment techniques
Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV

Antibiotic sensitivity test by disc diffusion assay

Module V

Biochemical and molecular characterization of micro organisms
Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: MSB 122 **Credit Units: 01**

Course Contents:

Module I

Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II

Isolation of chloroplast from spinach and study of electron transport chain.

Module III

Isolation of mitochondria and study of electron transport chain.

Module IV

Study of apoptosis by TUNEL method.
Site directed mutagenesis
Mutation detection and analysis
Mitosis
Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: CSE 123 **Credit Units: 01**
Total hours: 20

Course Contents:

Module I: Ms-Office (8 Hours)

Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003 (4 Hours)

Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.
SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language (8 Hours)

Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Course Outcomes:

The student will learn

- To operate MS word and its operations and functions
- To know the concepts of DBMS and its query execution.
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs

Examination Scheme:

IA			EE			
A	PR	Practical Based Test	Major Experiment	Minor Experiment	LR	Viva
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

ADVANCED COMMUNICATION-I

Course Code: BCP 141 **Credit Units: 1**

Course Objective:
The Course is designed to enhance vocabulary skills and make students fluent, thereby improving receptive and expressive skills.
Prerequisites: NIL.
Course Contents / Syllabus:

Module I Fundamentals of Communication.	**30% Weightage**
• Role and Purpose of Communication,7 C's of Communication • Barriers to Effective Communication • Forms of Communication: One-to-One, Informal and Formal	
Module II Oral Communication	**20% Weightage**
• Effective Listening: Principles and Barriers • Effective Speaking: Pronunciation and Accent	
Module III Building Advanced Vocabulary	**20% Weightage**
• Word Formation; Synonyms; Antonyms; Eponyms; Homonyms, Homophones & Homographs • One Word Substitution; Phrasal Verbs, Idiomatic Expressions & Proverbs • Foreign Words in English	
Module IV Non Verbal Communication	**30% Weightage**
• Principles & Significance • Kinesics, Oculesics, Proxemics,, Para-Language, Artifacts, Chronemics, Tactilics	
Student Learning Outcomes	
The students will be able to use the LSRW Skills to communicate effectively in a professional environment.Will be able to develop fluency.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

End Term Examination				
Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:
Jones, Working in English, 1st ed. Cambridge, CUP 2001
Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Butterfield, Jeff Soft skills for Everyone, Cengage Learning 2011
Reference: *Guffey, Ellen Mary, Business Communication, Thomson (South Western)*
Dale Carnegie: Quick and Easy Way of Public Speaking
Business Communication Today – Courtland L Bovee, John V Thill Mukesh Chaturvedi, Pearson 2009.
Additional Reading: Newspapers and Journals.

Behavioral Science – I

Course Code: BSP-143 **Course Credit: 01**
Total Hours: 10
Course Objective:
This course aims at imparting an understanding of:
elf and the process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and their effect on work behavior.
- Effective management of emotions and building interpersonal competence.

Course Contents:
Module I: Understanding Self **(2 Hours)**
- Formation of self concept
- Dimension of Self
- Components of self
- Self Competency

Module II: Self-Esteem: Sense of Worth **(2 Hours)**
- Meaning and Nature of Self Esteem
- Characteristics of High and Low Self Esteem
- Importance & need of Self Esteem
- Self Esteem at work
- Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power **(2 Hours)**
- Introduction to EI
- Difference between IQ, EQ and SQ
- Relevance of EI at workplace
- Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence **(2 Hours)**
- Need and importance of Emotions
- Healthy and Unhealthy expression of emotions
- Anger: Conceptualization and Cycle
- Developing emotional and interpersonal competence.
- Self assessment, analysis and action Plan.

Module V: Leading Through Positive Attitude **(2 Hours)**
- Understanding Attitudes
- Formation of Attitudes
- Types of Attitudes
- Effects of Attitude on
  - Behavior
  - Perception
  - Motivation
  - Stress
  - Adjustment
  - Time Management
  - Effective Performance

  Building Positive Attitude.

Student learning outcomes:
- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility.
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	**Attendance**	**Journal of Success (JOS)**	**Social Awareness Program (SAP) SAP Report/SAP Presentation**	**End Semester Exam**	**Total**
Weightage (%)	**5**	**10**	**15**	**70**	**100**

The above evaluation scheme shall not be applicable for LLM Course. Suggested Readings:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.,
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt.Ltd.,
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

Français-I

CourseCode:FLP144 **CreditUnits:02**

Course Objective:

Tofamiliarizethe studentswiththe Frenchlanguage
- withthe phonetic system
- withtheaccents
- withthemanners
- withthe cultural aspects

Toenablethe students
- toestablishfirstcontacts
- toidentifythingsandtalkaboutthings

CourseContents:

Unité 1,2: pp.01to37

Introductionàlalangue:système phonétique, accents, genre etaccord,jours,mois,nombres

Actesde communication:

Unité 1:Premierscontacts
1. nommerdesobjets,s'adresserpoliment à quelqu'un
2. se présenter, présenterquelqu'un
3. entrerencontact: dire tuouvous,épeler
4. dire oùontravaille,ce qu'onfait
5. communiquersescoordonnées

Unité 2:Objets
1. identifierdesobjets,expliquerleurusage
2. dire ce qu'onpossède,faireunachat,discuterle prix.
3. monteretsituerdesobjets
4. décrire desobjets
5. comparerdesobjets,expliquersespréférences

Grammaire:1.articlesindéfinis,masculinet fémininde snoms,pluriel desnoms

2.Je,il,ellesujets,verbesparler,habiter,s'appeler,être,avoir,masculinet fémininde sadjectifsde nationalité

3.tu,voussujets,verbesparler,aller,être,c'estmoi/c'esttoi

4.verbesfaire,connaître,vendre,c'est/il est +profession,quiest-ce ?qu'est- ce que...?

5.article défini,complément dunom avec de,quel interrogatif

6.adjectifspossessifs(1),pour+ infinitif

7. verbe avoir,ne...pas/pasde,questionavec est-ce que ?,questionnégative, réponse Si

8. Prépositionsdelieu, ilya/qu'est-ce qu'il ya

9 .accordet place desadjectifsqualificatifs,il manque...

10.comparatifsetsuperlatifs, pronomstoniques,pronomon

ExaminationScheme

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weight age (%)	15	10	5	**30**	**70**	

Text &References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

ADVANCED MOLECULAR BIOLOGY

Course Code: MSB 201 **Credit Units: 04**

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn and develop advanced understanding of mechanism of DNA replication in prokaryotes and eukaryotes.
- Learn the advanced mechanism of transcription in prokaryotes and eukaryotes.
- Develop understanding of various post-transcriptional processes in cell.
- Learn in detail about the mechanism of protein synthesis in prokaryotes and eukaryotes.
- Understand about the advances of gene expression regulation and various mechanisms of gene silencing.

Course Contents:

Module I: DNA replication and repair

DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA

Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA

Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation

Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.

Module V: Regulation of gene expression

Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing

RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme

Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: MSB 202 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes.Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: MSB 203 **Credit Units: 04**

Course Objective:
The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Learning Outcomes:
By the end of the course the student will be able to:

- Develop an understanding of the various aspects of bioprocess technology and their basic principles.
- Develop skills associated with controlling of various parameters of bioprocess monitoring.
- Understand principles underlying design of fermentor, fermentation Process and downstream processing.
- Get knowledge of industrial productions of various primary and secondary metabolites.

Course Contents:
Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: MSB 204 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

PART I: GENOMICS

Module I

Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II

Transcriptomics and metatranscriptomics: Introduction , method and uses.genetic mapping

Module III

Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV

Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V

Introduction to proteomics

Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI

Post translationalprotein modification

Module VII

Protein – protein interaction someexamples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: MSB 205 **Credit Units: 03**

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the development of computational biology.
- Describe the fundamentals of bioinformatics databases and their application.
- Understand and explain the use of various computational methods for phylogentic studies
- Use and apply the knowledge of different softwares and programs for sequence comparison, molecular modeling
- Explain the applications of computational biology in different fields of sciences.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

1. Major information Resources & Databases in Bioinformatics
   a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
   b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
   c. Derived (Secondry) Databases of Sequences and structure:
      i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
      ii. SCOP, CATH, DSSP, FSSP, RNAbase,
   d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
2. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
3. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
4. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
5. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
6. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
7. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)
Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.
Suffix tree and its applications in Bioinformatics
Gene Indentification Methods
Predictive Methods using DNA and Protein sequences.
Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.
Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.
Phylogenetics analysis software.
Molecular Structure drawing tool.
Molecular modeling/Docking.
Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.

***References*:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: MSB 206 **Credit Units: 03**

Course Objective:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I

Environmental pollution and its major impacts on human beings, plants, animals and climate, concept of Global warming and climate change, Global Ozone Problem, Eutrophication, Land degradation, Biomagnification.

Module II

Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III

Biodegradation, Bioremediation and Phytoremediation of major pollutants (PAH, Pesticides etc), Use of microbial technology for mining of metals (Bioleaching) and Concept of Biomineralisation.

Module IV

Waste water engineering: physicochemical characteristic of water, waste water treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V

Bioassessment of environmental quality: Biosensors and biomarkers, Principles of ecotoxicity.
Agriculture Sustainability and Clean agricultural practices: Biofertilizers, Biopesticides and vermi composting

Module VI

Environmental impact assessment and Environmental audit, Related case studies from India.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications” by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: MSB 220 **Credit Units: 02**

Course Contents:

1. Isolation of genomic DNA from prokaryotic and Eukaryotes.
2. Isolation of plasmid.
3. Study of DNA protein interaction.
4. Study of in vitro transcription.
5. Study of DNA methylation.
6. Study of DNA repair mechanism.
7. Invitro study of translation
8. Isolation of RNA
9. PCR and Gradient PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: MSB 221 **Credit Units: 02**

Course Contents:

1. Study of gene expression in E.coli.(GFP cloning).
2. Study of Southern Hybridization.
3. Study of RFLP/RAPD.
4. Study of Western blotting.
5. Study of restriction digestion.
6. Study of legation.
7. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: MSB 222 **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: MSB 223 **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II

PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF datausing PDquest software

Module IV

Primer designing, Analysis of protein 3D structures and comparison,.Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: MSB 224 **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Advanced Communication-II

Course Code: BCP 241 **Credit Units: 1**

Course Objective:

The course is designed to make the students ready for placement.

Prerequisites: NIL

Module I Job Correspondence	**20% Weightage**
• Job Applications • Resume & Profile Writing for Social Media • Follow Up Letter	
Module II Dynamics of Group Discussion	**30% Weightage**
• Methodology • Guidelines	
Module III Speaking for Employment	**50% Weightage**
• Types of Interview (Technical & HR Rounds) • Fundamentals of Facing Interviews • Question Answer on Various Dimensions • Non-Verbal Communication Component • Interview Etiquettes	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures **Student Learning Outcomes:** The student will be able to write an impressive resume and face the interview confidently.	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100`%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Bovee, L Courtland, Mukesh chaturvedi, and John U Thill, Business Communication Today, Pearson

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Comfort, Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)

Stay Hungry, Stay Foolish: Rashmi Bansal

Business Maharajas: Gita Piramal

How to Make Friends in Digital Age: Dale Carnegie

Business Communication / Making Connections in a Digital World, Raymond V. Lesikar, Marie E Flattey, Kathryn Rentz, Neerja Pande, Mc Graw Hill, 2009

Additional Reading: Newspapers and Journals.

BEHAVIORAL SCIENCE-II

Course Code: BSP-243 **Credit unit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.
- Enhancing personal effectiveness and performance through effective interpersonal communication
- Enhancing their conflict management and negotiation skills.

Course Contents:

Module I: Conflict Management **(2 Hour)**

- Meaning and nature of conflicts
- Types of Conflict
- Styles and Techniques of conflict management
- Conflict management and interpersonal communication

Module II: Behavioral & Interpersonal Communication **(2 Hours)**

- Importance of Interpersonal Communication
- Rapport Building – NLP, Communication mode
- Steps to improve interpersonal communication
- Meaning and Nature of Behavioural Communication
- Relevance of Behavioural Communication

Module III: Relationship Management for Personal and professional Development **(2 Hours)**

- Importance of relationships
- Maintaining healthy relationships
- Communication Styles
- Types of Interpersonal Relationships

Module IV: Stress Management **(2 Hours)**

- Understanding of Stress & GAS Model
- Symptoms of Stress
- Individual and Organizational consequences with special focus on health
- Healthy and Unhealthy strategies for stress management
- Social support for stress management and well being
- Stress free, Successful and Happy Life

Module V: Conflict Resolution & Management **(2 Hours)**

- Conflict Resolution Strategies
- Ways of Managing Conflict (Healthy & Unhealthy)
- Impact of Conflict Resolution & Management.

Student learning outcomes

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme.

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course.

Suggested Readings:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel.
- Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
- Harvard Business School, Effective Communication: United States of America.
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

Français-II

CourseCode:FLP 244 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictoolstoenable the students
- totalkabouttime schedules
- totalkabouttravel
- toperform simple communicative tasks(fixappointments,makereservations,discusshabits,giveadvice, directions)

CourseContents:
Unité 3, 4: pp. 42 to 72:
Actes de communication:

Unité 3 : Emploi du temps.

1. demanderet donnerl'heure,deshoraires
2. racontersa journée
3. parlerde seshabitudesautravail,de sesloisirs
4. dire la date,parlerdutempsqu'ilfait
5. fixerrendez-vous (autéléphone pare-mail),réserverunetable aurestaurant

Unité 4:Voyage

1. réserverune chambre d'hôtel,demanderla note
2. expliquerunitinéraire
3. parlerde sesdéplacements,situersurune carte
4. exprimerunconseil,uneinterdiction,une obligation
5. acheterunbilletdetrain,consulteruntableaud'horaires

Grammaire:

1.questionavec à quelleheure? adjectifsdémonstratifs
2. verbespronominauxauprésent,lesprépositionsà et de : alleràvenirde
3.adverbesde fréquence, pourquoi...? Parce que ...?
4. expressionindiquant la date, verbesimpersonnels
5. verbe pouvoir+ infinitif,lelundi,lundi prochain
6. adjectifspossessifs(2), adjectiftout
7. impératifprésent(1),nombresordinaux
8. questionsavec est-ce que ? àeten+ moyendetransport,en/au+pays
9.verbesdevoir+infinitif,il faut+ infinitif,ilest interdit de
10.verbes:aller,venir,partir,questionsavec d'où,où,paroù,à quel,de quel.

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

ADVANCED IMMUNOLOGY

Course Code: MSB 301 **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies.
- Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions.
- Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity.
- Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.

Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: MSB 302 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Learning Outcomes

Having successfully completed this course, students will be able to:

- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Course Contents:

Module I: Enzymes

Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics

Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes

Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors

Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design

Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends

Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: MSB 303 **Credit Units: 03**

Course Objective:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Learning out comes:

After successful completion of the course student will be able to:

- Understand conventional and advanced aspects of Animal biotechnology.
- Learn the cell culture media, cell culture methods and their maintenance.
- Identify therapeutic enzymes, strategies of efficient enzyme replacement therapy methods.
- Understand concept of DNA vaccines and other vaccines using animal cell culture.
- Address the concepts and technology behind Gene therapy.
- Learn molecular mechanism of transgenic animal technology., Gene knockout tech.

Course Contents:

Module I

Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II

Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III

DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV

Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V

Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: MSB 304 **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Learning out comes:

After successful completion of the course student will be able to:

- Understand organogenesis, micropropagation, haploid and Embryo resue.
- Develop knowledge of cloning binary and expression vector, transformation in plants.
- Learn molecular techniques for identification of transgenics.
- Understand plant genome organization, gene families and delay of fruit ripening.
- Get knowledge of different biotic and abiotic stress resistant plant development.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques

Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II

Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III

Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV

Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V

Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DESIGN AND DEVELOPMENT

Course Code: MSB 305 **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Learning outcomes:

By the end of the course the student will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

DRUG DELIVERY SYSTEMS

Course Code: MSB 306 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).

Module III: Drug administration

Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: MSB 307 **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I

Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III

DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics,Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs**.**

Module IV

Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations

Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: MSB 308 **Credit Units: 03**

Course Objective:
The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:
- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: MSB 309 **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases. Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, SignalTransduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections ofNH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change inlight reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), LubertStryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: MSB 310 **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code: MSB 311 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

1. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
2. Organizational Structure and management
3. Capital Management
4. Product innovation and management
5. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

1. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
2. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
3. Basics of material management

Module III

1. Kaizen { Continuous improvement in product and management }
2. Six Sigma
3. Biotech enterprises: Small, Medium and Large.
4. Quality control in Biotech industries.

Module IV

1. Government Regulations for Biotech product.
2. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
3. Business development for medical products.
4. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne& Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

ADVANCED IMMUNOLOGY LAB

Course Code: MSB 320 **Credit Units: 01**

Course Contents:

1. Purification of immunoglobin G.
2. Study of antigen- antibody pattern (ODD).
3. Study of sandwich ELISA.
4. Study of haemeagglutination.
5. Study of immunoelectrophoresis.
6. Isolation and identification of rosette cells.
7. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

.

ENZYME TECHNOLOGY LAB

Course Code: MSB 321 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: MSB 322 **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

1. Histological study of important animal tissues.
2. Estimation of enzyme activity from animal tissues.
3. Study of toxicity on invitro model.
4. Culture and maintenance of animal cell lines.
5. Culture of chickenfibroblasts.
6. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

1. Tissue culture lab and organization.Sterilisation of glasswares, tools and equipments.
2. Preparation of stocks and media.Surface sterilization of various explants
3. ORGAN CULTURE
4. Cllus culture
5. Anther culture
6. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

SUMMER INTERNSHIP

Course Code: MSB 350 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Summary

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: MSB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

The report should be hard bound and for color coding scheme refer NTCC guidelines.

It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time
- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.

Project execution is concerned with assessing how much work has been put in.

The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Master of Technology (Biotechnology)

Programme Code: MTB

Duration – 2 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2021 – 2023

AMITY UNIVERSITY
MADHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July, 2021

PROGRAMME OBJECTIVE

Biotechnology is the technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.The main objective of this programme is to provide a balanced and comprehensive knowledge of the basic as well as applied sciences related to Biotechnology that would enhance the basic aptitude of each student and prepare them to take up the challenges in the varied and multi-faceted applications of Biotechnology. It will empower the students with the latest tools, techniques and awareness in biotechnology and will facilitate comprehensive learning combining the scientific and technological aspects

PROGRAMME STRUCTURE

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB101	Biochemistry & Metabolic Regulation	4	-	-	4	
MTB102	Advanced Microbial Technology	4	-	-	4	
MTB103	Instrumentation in Biotechnology	4	-	-	4	
MTB104	Bioinformatics	4	-	-	4	
MTB105	Advance Biostatistics for Biologists	3	-	-	3	
MTB120	Biochemistry Lab	-	-	4	2	
MTB121	Microbiology Lab	-	-	2	1	
MTB122	Instrumentation in Biotechnology Lab	-	-	2	1	
MTB123	Bioinformatics Lab	-	-	2	1	
	TOTAL				**24**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP141	Advanced Communication - I	30	-	-		
BSP143	Behavioural Science - I	30	-	-		

SECOND SEMESTER

Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses:						
MTB201	Cell & Molecular Biology	4	-	-	4	
MTB202	Recombinant DNA Technology	4	-	-	4	
MTB203	Bioprocess Technology	4	-	-	4	
MTB204	Genomics & Proteomics	4	-	-	4	
MTB205	Pharmaceutical Biotechnology	3	-	-	3	
 MTB206 MTB207 MTB208 MTB209 MTB210 MTB211	**Elective-I (any one)** • Environmental Biotechnology • Biosensors • Artificial Neural Networks • Agriculture Biotechnology • Fundamentals of Computers & Programming in "C" • Bio-energy Engineering	3	-	-	3	
MTB220	Cell & Molecular Biology Lab	-	-	4	2	
MTB221	Recombinant DNA Technology Lab	-	-	4	2	
MTB222	Bioprocess Technology Lab	-	-	4	2	
MTB223	Genomics & Proteomics Lab	-	-	2	1	
	TOTAL				**29**	
Optional Courses - Value Added Courses; Any Three: Hrs/Semester						
BCP241	Advanced Communication - II	30	-	-	1	
BSP243	Behavioural Science - II	30	-	-	1	

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SUMMER PROJECT: 8 - 10 WEEKS

THIRD SEMESTER

Compulsory Courses:						
MTB301	Immunology & Immunotechnology	4	-	-	4	
MTB302	Enzymology & Enzyme Technology	4	-	-	4	
MTB303	Drug Design & Development	4	-	-	4	
MTB304	Bioprocess Plant Design	3	-	-	3	
 MTB305 MTB306 MTB307 MTB308 MTB309 MTB310	**Elective - II (any one)** • Pollution Prevention Fundamentals • Drug Delivery Systems • IPR, Biosafety & Bioethics • Advanced Food Technology • Industrial Safety & Management • Advanced Animal & Plant Cell Technology	3	-	-	3	
MTB320	Immunology & Immunotechnology Lab	-	-	4	2	
MTB321	Enzymology & Enzyme Technology Lab	-	-	2	1	
MTB360	Summer Project (Evaluation)	-	-	-	12	
	TOTAL				**33**	

FOURTH SEMESTER

Compulsory Courses:						
MTB460	Project (20-22 weeks)	-	-	-	30	
	TOTAL				**30**	

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: MTB 101 **Credit Units: 04**

Course Objective:

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn and understand the structure of biomolecules from their monomers to polymers.
- Learn the metabolism of biomolecules at advanced level and they will be able to interconnect these pathways.
- Learn about different levels of regulation of enzymes in metabolic pathways.
- Develop understanding of role of energy in various biochemical reactions.
- Learn regulation of various metabolic pathways and diseases due to misregulation of metabolic pathways.

Course Contents:

Module I

Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II

Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III:Modes of Regulation

Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways

Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation, Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry by A. Lehninger revised by Nelson and Cox.
- Biochemistry by Mathews, Van Holde and Ahern. IIIrd Edition.

References:

- “Biochemistry” by White, Handler and R.B. Smith 7th Ed. 1983
- Biochemistry” by L.Stryer Third Edition.
- Biochemistry by Voet and Voet.
- Fundamentals of Biochemistry by Conn and Stumph.

ADVANCED MICROBIAL TECHNOLOGY

Course Code: MTB 102 **Credit Units: 04**

Course Objective:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around us.
- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

Course Contents:

Module I

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

Module II

Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

Module III

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

Module IV

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

Module V

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill.
- Microbiology by Prescott.

References:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: MTB 103 **Credit Units: 04**

Course Objective:

To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand centrifugation machine and their techniques for the separation of biomolecules.
- Know about electrophoresis and their different types and their application.
- Know about chromatography techniques and their different types and their application
- Know different types of spectroscopes and microscopes and their application analysis of different molecules.
- Learn about the radioactivity and their measurement using scintillation counters.

Course Contents:

Module I: Ultracentrifugation

Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

Module II: Gel electrophoresis

Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

Module III

TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

Module IV

UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.

Module V

Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Module VI

Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles & Techniques" by Keith Wilson and John Walker.
- Biophysical Chemistry by David Friefelder.

References:

- "Microscopic Techniques in Biotechnology" by Michael Hoppert
- "Principles & Practice of Bioanalysis" by Richard F. Venn
- "Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes" by J.F.
- Van Impe, Kluwer Academic
- "Crystal Structure Analysis" by J.P. Glusker and K.N. Trueblood, Oxford University Press
- "Crystallography made Crystal Clear" by G. Rhodes, Academic Press
- "NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry" by H. Gunter, John Wiley and Sons Ltd.
- "Principles of Physical Biochemistry" by K.E. Van Holde, Prentice Hall.

BIOINFORMATICS

Course Code: MTB 104 **Credit Units: 04**

Course Objective:

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand about nucleotide and protein sequence retrieval, submission through NCBI database.
- Understand the nucleotide and protein sequence alignment methods through different types of algorithm used.
- Predict the phylogenetic tree and evolutionary relationship
- Predict the databases related to functional gene sequences and their analysis through identification and classification
- Describe the molecular modeling using protein databank and molecular modeling databank.

Course Contents:

Module I: Introduction and overview

The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.

Module II

Exact string matching -classical comparison based methods, semi numerical string matching, suffix trees - construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison

Module III

Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.

Module IV

Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees , estimating the rate of change, likelihood and trees; analysis software.

Module V

Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases–PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure –minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Genomics and Bioinformaticsby C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

References:

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: MTB 105 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Learning Outcomes:

Upon course completion, students will be able to understand:

1. Fundamental knowledge of basic statistical Techniques.
2. Various Statistical Tools used in data presentation and interpretation
3. Probability and various distributions.
4. Formulation and testing of hypothesis
5. Correlation & Regression analysis.
6. Analysis of variance(ANOVA)
7. Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

Course Contents:

Module I:Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III: Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

BIOCHEMISTRY LAB

Course Code: MTB 120 **Credit Units: 02**

Course Contents:

Module I: Proteins
Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity

Module II: Nucleic Acid
Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel.
Carbohydrate: Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar
Lipids: Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

MICROBIOLOGY LAB

Course Code: MTB 121 **Credit Units: 01**

Course Contents:

Module I
Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

Module II
Biochemical test – Indole test, methyl red test, vogesproskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY LAB

Course Code: MTB 122 **Credit Units: 01**

Course Objective:

To demonstrate the techniques used in the biotechnology for purification, characterization and identification of the proteins and other biotechnologically important products

Course Contents:

Module I: Cell disruption techniques

homogenization, sonication

Module II

Centrifugation – low speed and high speed.

Module III: Spectrophotometer techniques

Visible and UV spectrophotometry

Module IV

Chromatography-ion exchange, gel filtration and affinity columns, fraction collection, monitoring UV absorbance. Applications in enzyme purification.

Module V

Techniques for removal of salt/solvent from a sample -desalting, dialysis, ultrafiltration, speedvac, lyophilization etc.

Module VI

Electrophoresis –1 D (Polyacryamide gel electrophoresis and agarose) and 2D. Isoelectric focusing.

Module VII

Polarization and fluorescence microscopy

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOINFORMATICS LAB

Course Code: MTB 123 **Credit Units: 01**

Course Objective:

To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

Course Contents:

Module I

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein

Module II

Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm

Module III

Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing

Module IV

Phylogenetic prediction and analysis

Module V

Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.

Module VI

Finding transcription regulatory signals

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED COMMUNICATION-I

Course Code: BCP 141 **Credit Units: 1**

Course Objective:

The Course is designed to enhance vocabulary skills and make students fluent, thereby improving receptive and expressive skills.

Prerequisites: NIL.

Course Contents / Syllabus:

Module I Fundamentals of Communication.	**30% Weightage**
• Role and Purpose of Communication,7 C's of Communication • Barriers to Effective Communication • Forms of Communication: One-to-One, Informal and Formal	
Module II Oral Communication	**20% Weightage**
• Effective Listening: Principles and Barriers • Effective Speaking: Pronunciation and Accent	
Module III Building Advanced Vocabulary	**20% Weightage**
• Word Formation; Synonyms; Antonyms; Eponyms; Homonyms, Homophones & Homographs • One Word Substitution; Phrasal Verbs, Idiomatic Expressions & Proverbs • Foreign Words in English	
Module IV Non Verbal Communication	**30% Weightage**
• Principles & Significance • Kinesics, Oculesics, Proxemics,, Para-Language, Artifacts, Chronemics, Tactilics	
Student Learning Outcomes	
The students will be able to use the LSRW Skills to communicate effectively in a professional environment. Will be able to develop fluency.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

End Term Examination				
Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Jones, Working in English, 1st ed. Cambridge, CUP 2001*

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Butterfield, Jeff Soft skills for Everyone, Cengage Learning 2011

Reference: *Guffey, Ellen Mary, Business Communication, Thomson (South Western)*

Dale Carnegie: Quick and Easy Way of Public Speaking

Business Communication Today – Courtland L Bovee, John V Thill Mukesh Chaturvedi, Pearson 2009.

Additional Reading: Newspapers and Journals.

BEHAVIORAL SCIENCE-I

Course Code: BSP-143 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of self and the process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and their effect on work behavior.
- Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self **(2 Hours)**
- Formation of self concept
- Dimension of Self
- Components of self
- Self Competency

Module II: Self-Esteem: Sense of Worth **(2 Hours)**
- Meaning and Nature of Self Esteem
- Characteristics of High and Low Self Esteem
- Importance & need of Self Esteem
- Self Esteem at work
- Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power **(2 Hours)**
- Introduction to EI
- Difference between IQ, EQ and SQ
- Relevance of EI at workplace
- Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence **(2 Hours)**
- Need and importance of Emotions
- Healthy and Unhealthy expression of emotions
- Anger: Conceptualization and Cycle
- Developing emotional and interpersonal competence.
- Self assessment, analysis and action Plan.

Module V: Leading Through Positive Attitude **(2 Hours)**
- Understanding Attitudes
- Formation of Attitudes
- Types of Attitudes
- Effects of Attitude on
  - Behavior
  - Perception
  - Motivation
  - Stress
  - Adjustment
  - Time Management
  - Effective Performance

  Building Positive Attitude.

Student learning outcomes:
- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility.
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course. Suggested

Readings:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.,
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt.Ltd.,
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

CELL AND MOLECULAR BIOLOGY

Course Code: MTB 201 **Credit Units: 04**

Course Objective:

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn various aspects of protein targeting and transportation of small molecules across the membrane by different means.
- Learn and understand the cell cycle with check points and intracellular signaling mechanisms.
- Learn the mechanism of replication of DNA both in prokaryotes and eukaryotes and repair mechanisms processed by the cell.
- Learn in detail about the mechanism of transcription and post-transcriptional processes in prokaryotes and eukaryotes.
- Learn and understand the mechanism translation, gene expression regulation in prokaryotes and eukaryotes as well as gene silencing.

Course Contents:

Module I

Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.

Module II

Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.

Module III

Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.

Module IV: Replication

Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease.

Recombination & Repair: Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.

Module V

Transcription - RNA transcription and the proteins required for each step, maturation of the RNA transcript
derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression

Module VI: Translation

Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, translational recoding, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Molecular Cell Biology by Bruce Albert
- Molecular Biology by Lodish Darnell and Baltimore
- Molecular Biology of the gene by Watson et al 4th ed.

References:

- Genes VIII by Benjamin Lewis
- Genetics by Ursula Goodenough
- Cytogenetics by l Garl P. Swanson, Mertz & Young
- Biochemistry by Stryer
- Genome by T.A. Brown, John Willey and Sons Inc.

RECOMBINANT DNA TECHNOLOGY

Course Code: MTB 202 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

Module II: Gene isolation

Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

Module III: Heterologous gene expression (bacteria and yeast)

Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

Module IV: Studying gene regulation and control

In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

Module V: Automation and robotic advances in RDT

DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation

Module VI: Laboratory, industrial and environmental applications of RDT

High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Genes to Clone by Winnaker

References:

- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- "Gene Expression Technology" by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- "DNA Cloning: A Practical Approach" by D.M. Glover and B.D. Hames, IRL Press.

BIOPROCESS TECHNOLOGY

Course Code: MTB 203 **Credit Units: 04**

Course Objective:

The present course aims to aware about the requirements for large-scale cultivation of microbes for production of industrially important products with purification and characterization of these bioproducts using different techniques

Learning Outcomes:

By the end of the course the student will be able to:

- Develop an understanding of the various aspects of bioprocess technology and their basic principles.
- Develop skills associated with controlling of various parameters of bioprocess monitoring.
- Understand principles underlying design of fermentor, fermentation Process and downstream processing.
- Get knowledge of industrial productions of various primary and secondary metabolites.

Course Contents:

Module I

Introduction to Bioprocess Technology, Microbial growth kinetics-batch, continuous, cell recycle & fed- batch.

Module II

Substrates for bioconversion processes and design of media, sterilization; Cell culture techniques; Inoculum development and aseptic transfers. Bioreactors – CSTR, CSTR in series , tower, loops, airlift bubble column & packed bed. Different types of pumps, valves, and line materials, piping convections etc. used in Biochemical Processes

Module III

Process technology for the production of primary metabolites, e.g. Baker's yeast, ethanol, citric acid, amino acids (lysine and glutamic acid). Microbial production of industrial enzymes (glucose isomerase, cellulase, amylase, lipase, protease) and secondary metabolites (penicillins, cephalosporins and streptomycin). Biomass (SCP and mushroom) production from agro-residues.

Ethanol: production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition , uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery , uses of various forms etc.

Streptomycin – chemical structure, production, harvest and recovery, use, by-product of streptomycin fermentation etc.

Amino Acid: Genetic Control of metabolic pathway.

Lysine: Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

Glutamic Acid: Direct Fermentation, contribution of feed back control and regulation of cell permeability barrier for production.

Biomass: Bakers and distillers yeast production using various raw materials, "bios" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Module IV

Characteristics of bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biotechnology. A Textbook of Industrial Microbiology, W. Crueger and a. Crueger, Sinauer Associates.
- Principles of Fermentation Technology, P.F. Stanbury and A. Whitaker, Pergamon Press.
- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
- Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, W.F. Veith, John Wiley and Sons Inc.
- Biochemical Engineering, S. Aiba, A.E. Humphrey and N.F. Millis, University of Tokyo Press.
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lyderson and N. D'Elia, John Wiley and Sons Inc.
- Process Engineering in Biotechnology, A.T. Jackson, Prentice Hall.
- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.
- Biotreatment, Downstream Processing and Modelling (Advances in Biochemical Engineering/ Biotechnology, Vol 56), T. Scheper et al, Springer Verlag.
- Chromatographic and Membrane Processes in Biotechnology, C.A. Costa and J.S. Cabral, Kluwer Academic Publisher.
- Downstream Processing, J.P. Hamel, J.B. Hunter and S.K. Sikdar, American Chemical Society
- Protein Purification, M.R. Lodisch, R.C. Wilson, C.C. Painton and S.E. Builder, American Chemical Society.

GENOMICS AND PROTEOMICS

Course Code: MTB 204 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

GENOMICS

Module I: Introduction to Genomics
Anatomy of prokaryotic and eukaryotic genome. Contents of genomes, Repetitive DNA. Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes
Genome expression; RNA Contents, genetic mapping, Microsatellite DNA markers, RFLP, DNA sequencing, PCR, Micro array: DNA micro array marker, random primers, computational methods.

Module III
Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module IV
Introduction to proteomics. Protein structure: secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solutes. The activity of proteins. Protein engineering principles.

Module V
Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modifications. Protein – protein interaction.

Module VI
Use of computer simulations and knowledge-based methods in the design process. De-novo design; making use of databases of sequence and structure.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genomes II, T.A. Brown
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller

References:

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Genes & Genomes, Maxine Singer and Paul Berg
- DNA : Structure and Function, Richard R. Sinden
- www.panimaText.com

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: MTB 205 **Credit Units: 03**

Course Objective:

The main objectives are to cover representative pharmaceutical dosage forms, and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

Learning Outcomes:

After successful completion of the course student will be able to:
* Prepare different strength of solutions and get a thorough knowledge of analytical chemistry.
* Understand physicochemical properties of drug molecules, flow behaviour of fluids and powder.
* Learn the basics of polymer science and different packaging strategies to be used for pharmaceutical compounds.
* Understand the industrial processing of drugs and various transport phenomena.
* Get knowledge of the materials that are used for plant construction and understand Good Manufacturing practices.

Course Contents:

Module I
Introduction to Physical Pharmaceutics - Metrology and Calculations,

Module II
Molecular structure, properties and States of Matter, Solutions, Phase Equilibra, Micromeritic and Powder Rheology, Surface and Interfacial Phenomena, Dispersion Systems, Diffusion & Dissolution, Kinetics and drug stability, Viscosity & Rheology

Module III
Polymer Science and Applications, Formulations and Development, Packaging

Module IV
Introduction to Industrial Processing, Transport Phenomena (Fluid Flow, Heat Transfer and Mass Transfer)

Module V
Particulate Technology (Particle Size, Size reduction, Size Separation, Powder Flow and Compaction), Unit Operations (Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, and Drying)

Module VI
Materials of Pharmaceutical Plant Construction, Good Manufacturing Practice (GMP's) Guidelines

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Bentley's Pharmaceutics by E A Rawlins
- Pharmaceutical Sciences by Remington

References:
- Physical Pharmacy by Alfred Martin.
- Cooper and Gunn's Tutorial Pharmacy

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: MTB 206 **Credit Units: 03**

Course Objective:
To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I
Environmental pollution and its major impacts on human beings, plants, animals and climate, concept of Global warming and climate change, Global Ozone Problem, Eutrophication, Land degradation, Biomagnification.

Module II
Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III
Biodegradation, Bioremediation and Phytoremediation of major pollutants (PAH, Pesticides etc), Use of microbial technology for mining of metals (Bioleaching) and Concept of Biomineralisation.

Module IV
Waste water engineering: physicochemical characteristic of water, waste water treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V
Bioassessment of environmental quality: Biosensors and biomarkers, Principles of ecotoxicity.
Agriculture Sustainability and Clean agricultural practices: Biofertilizers, Biopesticides and vermi composting

Module VI
Environmental impact assessment and Environmental audit, Related case studies from India.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:
- Environmental Biotechnology – Concepts and Applications” by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

BIOSENSORS

Course Code: MTB 207 **Credit Units: 03**

Course Objective:

On completion of the module students should Be able to Appreciate the basic configuration and distinction among biosensor systems, To gain an understanding of general biosensor principles and terms, To be able to design, model, simulate, fabricate, and test a biosensor, To gain an overall knowledge of biosensor types, applications, requirements, and capabilities to allow improved interaction with physicians, clinicians, and biomedical engineers, and to enable the student to conduct biomedical engineering research.

Course Contents:

Module I
Introduction to MEMS

Module II: Biosensors
Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, SignalTransduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections ofNH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change inlight reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Module III: Biomedical sensors
Sensors and transducers: an overview, measurement systems, Classification of Biomedical sensors andtransducers, who do we need Biomedical sensors and Transducers? Important Design considerations and systemcalibration, the future of Biosensors and Transducers, Sensing Layer: The importance of computers in sensors and Transducer technology, Recent Engineering Solutions to Health care using Biosensors and Transducers, Modern health care solutions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Affinity Biosensors: Techniques and Protocol by K.R. Rogers and A. Mulchandani, Humana Press.
- Biosensors and their Applications by V.C. Yang and T.T. Ngo, Plenum Publishing Corporation.
- Chemical Sensors and Biosensors by B.R. Eggins, John Wiley and Sons Inc.

References:

- Sensors and Sensing in Biology and Engineering by F.G. Barth, wt al, Springer Verlag.
- Biosensors by Minh Canh. Tran
- Biosensors: Theory and Applications by Donald G. Buerk
- Enzyme and Microbial Biosensors: : Techniques and Protocols - by Kim R. Rogers, Ashok Mulchandani
- Biosensors in Environmental Monitoring - by Ursula Bilitewski, Anthony P. F. Turner.
- Biosensors: Micro electrochemical Devices - by Marc J. C. Lambrechts
- Biosensors with Fiberoptics - by Donald Lee Wise, Lemuel B. Wingard
- Biosensors and Their Applications - by That Tjien Ngo, Victor Chi-Min Yang
- Thermal Biosensors, Bioactivity, Bioaffinity -by Prakash K. Bhatia
- Novel Approaches in Biosensors and Rapid Diagnostic Assays - by ZviLiron, Avraham Bromberg, Morly Fisher
- Biosensors - by Anthony E. G. Cass.

ARTIFICIAL NEURAL NETWORKS

Course Code: MTB 208 **Credit Units: 03**

Course Objective:

This course will enable the students to gain knowledge about a relatively newer area of science. The course is designed to model the different technical properties, applications, besides the closely related aspects of artificial neural networks.

Course Contents:

Module I
Historical background, Why is learning hard?

Module II
Memorization, generalization and function approximation, Linear Associators, Perceptrons and Capacity, Multilayer neural networks, Maximum Likelihood and Gradient Descent learning, Stochastic gradient descent for supervised learning.

Module III
The back propagation algorithm, Aspects of Learning Theory and Generalization, Bias vs. variance, Overtraining, pruning and regularization, VC dimension and how much data is enough?.

Module IV
Neural networks and analog VLSI, Selected Applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Neural Networks: A Comprehensive Foundation by S. Haykin, Prentice Hall.

References:
- Neutral Networks for Pattern Recognition by C. Bishop, Oxford University Press.

AGRICULTURE BIOTECHNOLOGY

Course Code: MTB 209 **Credit Units: 03**

Course Objective:

This course is designed to cover key concepts in the structure and manipulation of DNA and inheritance of genes, traditional plant breeding, current impact of biotechnology on crop production and its commercial applications. Regeneration of plants through in vitro techniques offers a practical strategy for micro propagation.

Course Contents:

Module I

Sterilization; Nutrient medium; Callus & Suspension culture; canning, regulation; Micropropagation, production of virus free plants, anther culture, pollen culture; ovary culture, homozygous lines; meristem culture; somatic hybridization, somaclonal variation, germplasm conservation

Module II

Genetic engineering in plants, direct and indirect method of plant cell transformation, vectors with special reference to Ti plasmids, selectable markers, mechanism of T-DNA transfer to plants, transgenic plants, molecular maps and gene tagging, marker assisted selection

Module III

Applications of genetic engineering, insect and pest resistance, herbicide resistance, cytoplasmic male sterility in plants, molecular farming.

Module IV

Plant patents, plant variety certificates, safety regulation in transgenic plants.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

FUNDAMENTALS OF COMPUTERS AND PROGRAMMING IN 'C'

Course Code: MTB 210 **Credit Units: 03**

Course Objective:

The main objectives of the course are to demonstrate familiarity with computer, show understanding of computer hardware and software, display basic understanding of computer programming processes, develop understanding of computer file management and protection principles, explain Internet, LAN and digital media fundamentals, define information systems analysis and design concepts, identify and demonstrate use of database concepts.

Course Contents:

Module I
Introduction to Digital Computer:Major components of a Digital Computer - Number system - Binary codes - Fixed and Floating Pointrepresentation - Logic gates - Flip flops - Registers - Input and Output Devices.

Module II: Introduction to programming
Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program.

Module III: Data Types
Variables - Constants - Arithmetic expressions - Use of operators - program examples.

Module IV: Decision making in C
Relational operators - Logical operators - Precedence of operators - IF and IF ... ELSE statements – Loopingconcepts in C _ WHILE loop - DO ... WHILE and FOR loops - Programming examples.
Functions: User defined Functions - Local and Global variables - Parameters - Programming examples.

Module V: Arrays
BREAK statement - Strings and character arrays - examples.
Pointers: Concept of Pointers - The Indirection operator - Use of Pointers in arrays - Programming examples.

Module VI: Structures
The period operator - Arrays of structures - Arrays within structures - Structures within structures - Pointers to structures - The arrow operator - Programming examples.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Fundamentals of Computers by V. Rajaraman
- C Programming" by G. Kochan

References:

- Computer Fundamentals by B. Ram.
- The Spirit of C" by Mullish Cooper.

BIO-ENERGY ENGINEERING

Course Code: MTB 211 **Credit Units: 03**

Course Objective:

The goal is to introduce students to biotechnology and tools that enable engineers and process scientists to connect innovations in industrial microorganisms and bioprocess unit operations to the engineering fundamentals, fundamentals of systems biology, and biological tools for design, modeling and evaluation of manufacturing facilities for the production of biofuels, bioproducts and biotherapeutics using a case study approach combined with computer modeling.

Course Contents:

Module I: Biomass Sources, Characteristics & Preparation

Biomass Sources and Classification. – Chemical composition and properties of different biomass materials and bio-fuels – Sugar cane molasses and other sources for fermentation ethanol-Sources and processing of oils and fats for liquid fuels- Energy plantations

-Preparation of woody biomass: Size reduction, Briquetting of loose biomass, Drying, Storage and Handling of Biomass.

Module II: Biogas, Technology

Feedstock for biogas production, Aqueous wastes containing biodegradable organic matter, animal residues-. Microbial and biochemical aspects- Operating parameters for biogas production Kinetics and mechanism - Dry and wet fermentation. Digesters for rural application-High rate digesters for industrial waste water treatment.

Module III: Bio-Ethanol and Bio-Diesel Technology

Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

Module IV: Pyrolysis and Gasification of Biomass

Thermo-chemical conversion of ligno-cellulose biomass – Biomass processing for liquid fuel production - Pyrolysis of biomass-Pyrolysis regime, effect of particle size, temperature, and products obtained.

Thermo-chemical gasification principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidized Bed Gasifiers.

Module V: Combustion of Biomass and Cogeneration Systems

Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Fuels from Biomass and Wastes by D.L. Klass and G.M. Emert, Ann Arbor Science pub. Inc. Michigan,
- Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes by A. Chakraverthy, Oxford & IBH publishing Co., New Delhi,

References:

- Biogas Systems: Principles and Applications by K.M. Mital, New Age International Publishers (p) Ltd.,
- Biomass Energy Systems, by P. Venkata Ramana and S.N. Srinivas, Tata Energy Research Institute, New Delhi, 1996.
- Bio-gas Technology by Khandelwal K.C. and Mahdi, Tata McGraw-Hill pub. Co. Ltd., New Delhi
- Advances in bio-gas Technology by O.P. Chawla, I.C.A.R., New Delhi. 1970.

CELL AND MOLECULAR BIOLOGY LAB

Course Code: MTB 220 **Credit Units: 02**

Course Objective:
The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

Course Contents:
1. Isolation of genomic DNA from prokaryotic and Eukaryotes
2. Isolation of plasmid.
3. Study of apoptosis by TUNEL method
4. Isolation of cell organelles by ultracentrifugation.
5. Study of in vitro transcription.
6. Study of DNA repair mechanism
7. Site-directed mutagenesis
8. Isolation of RNA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

RECOMBINANT DNA TECHNOLOGY LAB

Course Code: MTB 221 **Credit Units: 02**

Course Contents:

1. Preparation and Transformation of competent cells by CaCl2 method.
2. Restriction digestion
3. Legation
4. Southern hybridization
5. Western blotting
6. RFLP
7. PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

BIOPROCESS TECHNOLOGY LAB

Course Code: MTB 222 **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

GENOMICS AND PROTEOMICS LAB

Course Code: MTB 223 **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins

Module II

DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Analysis of 2D – IEF data

Module IV

Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

Advanced Communication-II

Course Code: BCP 241 **Credit Units: 1**

Course Objective:

The course is designed to make the students ready for placement.

Prerequisites: NIL

Module I Job Correspondence	20% Weightage
• Job Applications • Resume & Profile Writing for Social Media • Follow Up Letter	
Module II Dynamics of Group Discussion	**30% Weightage**
• Methodology • Guidelines	
Module III Speaking for Employment	**50% Weightage**
• Types of Interview (Technical & HR Rounds) • Fundamentals of Facing Interviews • Question Answer on Various Dimensions • Non-Verbal Communication Component • Interview Etiquettes	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures **Student Learning Outcomes:** The student will be able to write an impressive resume and face the interview confidently.	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100`%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text:

Bovee, L Courtland, Mukesh chaturvedi, and John U Thill, Business Communication Today, Pearson

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Comfort, Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)

Stay Hungry, Stay Foolish: Rashmi Bansal

Business Maharajas: Gita Piramal

How to Make Friends in Digital Age: Dale Carnegie

Business Communication / Making Connections in a Digital World, Raymond V. Lesikar, Marie E Flattey, Kathryn Rentz, Neerja Pande, Mc Graw Hill, 2009

Additional Reading: Newspapers and Journals.

BEHAVIORAL SCIENCE-II

Course Code: BSP-243 **Credit unit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of:
- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.
- Enhancing personal effectiveness and performance through effective interpersonal communication
- Enhancing their conflict management and negotiation skills.

Course Contents:

Module I: Conflict Management **(2 Hour)**
- Meaning and nature of conflicts
- Types of Conflict
- Styles and Techniques of conflict management
  - Conflict management and interpersonal communication

Module II: Behavioral & Interpersonal Communication **(2 Hours)**
- Importance of Interpersonal Communication
- Rapport Building – NLP, Communication mode
- Steps to improve interpersonal communication
- Meaning and Nature of Behavioural Communication
  - Relevance of Behavioural Communication

Module III: Relationship Management for Personal and professional Development **(2 Hours)**
- Importance of relationships
- Maintaining healthy relationships
- Communication Styles
  - Types of Interpersonal Relationships

Module IV: Stress Management **(2 Hours)**
- Understanding of Stress & GAS Model
- Symptoms of Stress
- Individual and Organizational consequences with special focus on health
- Healthy and Unhealthy strategies for stress management
- Social support for stress management and well being
- Stress free, Successful and Happy Life

Module V: Conflict Resolution & Management **(2 Hours)**
- Conflict Resolution Strategies
- Ways of Managing Conflict (Healthy & Unhealthy)
- Impact of Conflict Resolution & Management.

Student learning outcomes
- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme.

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course.

Suggested Readings:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel.
- Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
- Harvard Business School, Effective Communication: United States of America.
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR).
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: MTB 301 **Credit Units: 04**

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease Processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies.
- Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions.
- Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity.
- Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.

Course Contents:

Module I

Phylogeny of Immune System, Types of immunity clonal nature of immune response. Organization and structure of lymphoid organs. Antibody structure and function. Major histocompatibilty: Complex BCR and TCR, generation of antibody diversity, Complement system

Module II: Cells of the immune system

Hematopoiesis and differentiation, antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance.

Module III

Cell mediated toxicity, Hypersensitivity, Autoimmunity, Vaccines:General considerations, ideotype network hypothesis

Module IV

Tumor immunology, Transplantation immunology, Immunotheropy.

Module V

Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, (FACS) Hybridoma technology and its application

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Immunology by J. Kubey Fence Creek Publishing (Blackwell).
- Immunology by Ivan Riott

References:

- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Roitt, Mosby – Yearbook Inc.

ENZYMOLOGY AND ENZYME TECHNOLOGY

Course Code: MTB 302 **Credit Units: 04**

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Learning Outcomes

Having successfully completed this course, students will be able to:

- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Course Contents:

Module I: Enzymes

General characteristics of enzymes, Mechanism of action of few enzymes: lysozyme, ribozymes, chymotrypsin and alcohol dehydrogenase.

Module II: Enzyme Kinetics

Single substrate steady state kinetics; Multisubstrate systems, Enzyme Inhibitors as therapeutic agents, active site, Isozyme and multienzyme complex.

Module III: Applications of enzymes

Clinical and Industrial, Enzyme Immobilization and its applications.

Module IV: Enzyme Reactors

Reactors for batch/continuous enzymatic processing, Choice of reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design

Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends

Catalytic antibodies, Thermostable enzymes with special references to amylases, lipases and proteases.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems by I.H. Segel, Wiley-Interscience
- Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press.

References:

- Biotechnological Innovations in Chemical Synthesis by R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis by R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer
- Industrial Enzymes & their applications by H. Uhlig, John Wiley and Sons Inc.

DRUG DESIGN AND DEVELOPMENT

Course Code: MTB 303 **Credit Units: 04**

Course Objective:

The aim of the course is to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Learning outcomes:

By the end of the course the student will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research by J.A. Glasel and M.P.Deutscher, Academic Press
- Principles of Drug Action" by W.B. Pratt and P. Taylor, Churchill Livingston.

References:

- Principles of Medicinal Chemistry" by W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins.
- Side Effects and Drug Desig by E.J. Lien, Marcel Dekker
- The Anticancer Drugs by W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.

BIOPROCESS PLANT DESIGN

Course Code: MTB 304 **Credit Units: 03**

Course Objective:

The objective of this paper is to include the application of chemical engineering principles/unit operations to bioprocess systems and the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the general design information about a bioprocess plant.
- Know the concept of energy and mass balance is well known to students.
- Understand the basic flow sheeting and design of a basic batch and continuous type of fermentor.
- Understand about vessels used for the biotechnological applications.
- Understand the selection and specifications of equipments and cleaning used in a bioprocess plant is well known to students.

Course Contents:

Module I
Introduction; general design information; Mass and energy balance.

Module II
Flow sheeting; Piping and instrumentation; Materials of construction for bioprocess plants; Mechanical design of process equipment.

Module III
Vessels for biotechnology application; Design of fermenters; Design considerations for maintaining sterility of process streams processing equipment.

Module IV
Selection and specification of equipment for handling fluids and solids; Selection, specification, design of heat and mass transfer equipment used in bioprocess industries.

Module V
Design of facilities for cleaning of process equipment used in biochemical industries.

Module VI
Utilities of biotechnology production plants; Process economics; Bioprocess validation; Safety considerations; Case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Applied Process Design for Chemical and Petrochemical Plants by E.E. Ludwig, Butterworth-Heinemann.
- Chemical Engineering by R.K. Sinnott, J.M. Coulson and J.F. Richardson, Butterworth-Heinemann.

References:

- Chemical Engineers Handbook by R.H. Perry and D.W. Green, McGraw-Hill
- Manufacturing Facilities Design and Material Handling by F.E. Meyers and M.P. Stephens, Prentice Hall
- Plant Design and Economics for Chemical Engineers by M. Peters and K. Timmerhaus, McGraw-Hill
- Process Plant Layout and Piping Design by E. Bausbacher and R. Hunt, Prentice Hall PTR.

POLLUTION PREVENTION FUNDAMENTALS

Course Code: MTB 305 **Credit Units: 03**

Course Objective:

To develop an understanding of the methods and impacts of waste minimization including waste pollution prevention and recycling, obtain an overview of relevant environmental laws and regulations governing waste management, understand the phenomena and environmental impact of green-house gases and alternative energy sources to reduce the effect of global warming.

Course Contents:

Module I: Pollution Prevention in Industries

Environment friendly chemical processes-Properties and fates of environmental contaminants- Regulations for clean environment and implications for industries – Improved Manufacturing Operations.

Module II: Life Cycle Assessment and Environmental Audit

Life cycle assessment and pollution prevention economics-Hazard and risk Analysis - Pollution prevention planning - Design for the environment.

Module III: Conservation of Materials and Energy

Water energy and reagent conservation – Residuals management –
Economic Recovery and Recycling of Wastes - Case studies.

Module IV: Total Quality Environment Management and Ems 14000

Municipal pollution prevention programmes –Environment Management System-14000- Systematic, Structured and Documented Response to Environmental Issues- Auditable and Time Targeted Environmental Improvement Programs.

Module V: Hierarchy of Environment Management Practices

Waste-specific pollution prevention: waste pre - generation focus on minimization / recycling, Waste-specific pollution control treatment: pre – generation focus on disposal/ recycling- Waste-specific Post-release-to environment focus: recycling/ remediation

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pollution Prevention: Fundamentals and Practice by Bishop P., McGraw-Hill International Edition, McGraw-Hill book Co, Singapore
- Green Chemistry: Theory and Practice by P.T. Anastas and J.C. Warner,, Oxford University Press. N.Y.

References:

- Chemical Technology for better Environment by T.K. Roy, (Editor), Allied publishers Ltd, Chennai
- Pollution Prevention through Process Integration: Systematic Design Tools by El Halwagy, M.M, Academic Press, N.Y.

DRUG DELIVERY SYSTEMS

Course Code: MTB 306 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery
Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting
Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).

Module III: Drug administration
Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material
Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting
Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

IPR, BIOSAFETY AND BIOETHICS

Course Code: MTB 307 **Credit Units: 03**

Course Objective:

The objectives of the course are to explain the fundamental principles of IPR issues and examine information policy issues from different perspectives. Students will study and assess policy groups, intellectual property rights, access to information and research policy issues that usually include plant, animal and microbial genetic engineering products

Course Contents:

Module I

Objectives of Intellectual Property Rights, origin and evolution of IPR, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Patent, Industrial Design, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties

Module II: IPR

National and international perspective,TRIPS and WIPO

Module III: Patent

Basic criterion for patentability, patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and international perspective, Case study: Basmati case, Neem controversy, Turmeric Case

Module IV: Biosafety

Definition and requirement; biosafety in relation to human health, environment, transgenic research and applications, biosafety laws, guidelines and conventions, biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule ; Regulation bodies at National and International level

Module V

Legal and socioeco'nomic impact of the products and techniques in Biotechnology, Bioethics in plant, animal and microbial genetic engineering, Ethical issues in healthcare, Biopiracy and ethical conflicts

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Coyles information highway handbook; A Practical File on the New Information Order, American Library Association, 2000.
- American Indian Cultural & Research Journal *(UCLA)*

References:

- Refer to Periodicals, Industry directories, Articles and report in journals on the regulatory issues, "Biotechnology" series by Rehm & Reed.

ADVANCED FOOD TECHNOLOGY

Course Code: MTB 308 **Credit Units: 03**

Course Objective:

The purpose of the Food Technology major is to produce professionals with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research

Course Contents:

Module I

Processing and preservation technologies used in the food industry: heating, drying and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies

Module II

Micro-organisms and their metabolites for food, feed and fuel, development and application of food enzymes: fungal amylases, alpha-amylase, pectinase, amyloglucosidase and catalase. Technology for improvement of the quality of fruit juice through enzymatic treatment, Food spoilage and food poisoning micro-organisms

Module III

Pre- and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage

Module IV

Development of environment-friendly packaging materials based on product characteristics and performance properties of packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminium containers, and retortable pouches based on heat penetration studies and sterilization value

Module V

Food Safety in food service Establishment and other food areas

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Food Technology by Fraziar
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Evaluation Of Certain Food Additives And Contaminants, (WHO Technical Report Series 901) World Health Organization, Avenue Appia 20, 1211 Geneva 27, Switzerland
- International Journal of Food Science & Technology, Blackwell synergy publication
- Bioterrorism and Food Safety by Rasco and Bledsoe.

INDUSTRIAL SAFETY AND MANAGEMENT

Course Code: MTB 309 **Credit Units: 03**

Course Objective:
Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

Course Contents:

Module I: Hazards
Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

Module II: Psychology and Hygiene
Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

Module III: Occupational diseases and control
Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

Module IV: Management
Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

Module V: Laws
Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S .Wood Wiley Interscience,

References:
- Industrial Safety and Laws by Indian School of Labour Education, Madras.

ADVANCED ANIMAL AND PLANT CELL TECHNOLOGY

Course Code: MTB 310 **Credit Units: 03**

Course Objective:

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

ADVANCED ANIMAL CELL TECHNOLOGY

Module I

Brief history of animal cell and organ culture, Cultivation of animal cell *en masse* in bioreactor, methods for scale-up, immobilized cell culture, insect cell culture, somatic cell culture, organ culture, and embryo culture.

Module II

Valuable products from cell culture, Production of recombinant tissue-plasminogen-activator, blood factor VIII, erythropoietin, insulin, somatostatin, somatotropin.

Module III

Hybridoma technology, Monoclonal antibodies- production and application, Stem cell technology, custom made animals and tissue engineering

ADVANCED PLANT CELL TECHNOLOGY

Module IV

Brief introduction to various tissue culture techniques,

Cell Cultures, regeneration and preservation: Plant regeneration through meristem, callus (somatic embryogenesis) and anthers. Protoplast culture and somatic hybridization. Production, preservation and use of somatic embryos. Artificial Seeds and Cybrids.

Module V

Induction & utilization of somatic variants; Secondary metabolite production through cell cultures. Principles and the technology, pharmaceutical, secondary metabolites & beverage production; Commercialization of tissue culture technology (Micropropagation). Plant cell reactors. Immobilized plant cell reactors

Module VI

Engineering of Chloroplast and mitochondrial genomes and their applications, Biotransformation by plant cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss

References:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Cell & Tissue Culture for the Production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

IMMUNOLOGY AND IMMUNOTECHNOLOGY LAB

Course Code: MTB 320 **Credit Units: 02**

Course Objective:

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

Course Contents:

Module I

Blood film preparation and identification of cells, Identification of blood group, Isolation of serum.

Module II

Lymphoid organs and their microscopic organization.

Module III

WIDAL Test, Radial Immuno Diffusion Test, Ouchterlony Double diffusion Test, ELISA:- DOT, SANDWICH

Module IV

Purification of IgG through affinity chromatography

Module V

Immunohistochemistry

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ENZYMOLOGY AND ENZYME TECHNOLOGY LAB

Course Code: MTB 321 **Credit Units: 01**

Course Objective:

To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells

Course Contents:

Module I

Isolation of Enzymes from plant and microbial sources.

Module II

Enzyme assay; activity and specific activity – determination of amylase, acid phosphatase, cellulase, protease.

Module III

Production of enzyme on industrial scale using solid and liquid-state fermentation.

Module IV

Purification of enzyme by ammonium sulphate fractionation, ion-exchange, gel permeation chromatography.

Module V

Enzyme Kinetics: Determination of Michaelis-Menten constant (Km) and Maximum Velocity (Vmax), Temperature optima and pH optima of an enzyme.

Module VI

Enzyme immobilization and its effect on enzyme activity

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

SUMMER PROJECT

Course Code: MTB 360 **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- ## Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- ## Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- ## Abstract

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- ## Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- ## Review of Literature and Definition of Problem

- ## Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article
Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.
For book:
Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)
Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Dissertation:	50
Viva Voce:	50
Total:	**100**

PROJECT

Course Code: MTB 460 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

The report should be hard bound and for color coding scheme refer NTCC guidelines.

It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.

This does not include the page count of the appendices.

With regard to the text please note:

Color: Black on white

Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:

(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.
In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.
Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.
If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.
In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.
(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text.List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
Incase the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time

- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information

Control Quality

Draw Conclusions

Assessment Scheme:

Continuous Evaluation: 40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/ mid-course corrections etc. as reflected in the Project File.)

Final Evaluation: 60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Bachelor of Science and Master of Science (Biotechnology) "Dual Degree"

Programme Code: BMB

Duration – 5 Years Full Time

Programme Structure

And

Curriculum & Scheme of Examination

Batch: 2021 – 2026

AMITY UNIVERSITY
MAHYA PRADESH

PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2021

PROGRAMME OBJECTIVE

B.Tech. degree program integrates bio-sciences and bio-engineering with multidisciplinary linkages embedded in the design of the curriculum. The main objective of the programme is to develop highly skilled professionals in varied areas of biotechnology. The students will be familiarized with advancements in genetic engineering, bioprocess engineering, immunotechnology, plant and animal biotechnology.

The highlight of the programme is to give wider coverage of biotechnology education, developing understanding of the intriguing issues related to life system, biotech product development and bioengineering.

The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

PROGRAMME STRUCTURE

FIRST SEMESTER

New Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses						
BMB 101	Cell Biology	3	-	-	3	
BMB 102	Maths& Biostatistics	3	-	-	3	
BMB 103	Plant Sciences – I	3	-	-	3	
BMB 104	Animal Sciences-I	3			3	
BMB 105	Chemistry – I	3	-	-	3	
BMB 120	Biotechnology Lab - I	-	-	2	1	
BMB 121	Chemistry Lab – I	-	-	2	1	
BMB 122	Plant Sciences Lab - I	-	-	2	1	
BMB 123	Animal Sciences Lab-I			2	1	
EVS 142	Environmental Studies - I	2	-	-	2	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 141	Communication Skill - I	30	-	-		
BSU 143	Behavioural Science - I	30	-	-		
	Foreign Language - I	30	-	-		
FLU 144	French - I					
FLU 145	German					
FLU 146	Spanish					
FLU 147	Japanese					
FLU 148	Chinese					

SECOND SEMESTER

Compulsory Courses						
BMB 201	Introductory Biochemistry & Biophysics	3	1	-	4	
BMB 202	Bioanalytical Techniques	3	-	-	3	
BMB 203	Plant Sciences – II	3	-	-	3	
BMB 204	Animal Sciences-II	2	1		3	
BMB 205	Chemistry – II	3	-	-	3	
BMB 220	Biotechnology Lab – II	-	-	2	1	
BMB 221	Chemistry Lab – II	-	-	2	1	
BMB 222	Plant Sciences Lab – II	-	-	2	1	
BMB 223	Animal Sciences Lab-II	-	-	2	1	
EVS 242	Environmental Studies - II	2	-	-	2	
	TOTAL				**22**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 241	Communication Skill - II	30	-	-		
BSU 243	Behavioural Science - II	30	-	-		
	Foreign Language - II	30	-	-		
FLU 244	French - II					
FLU 245	German					
FLU 246	Spanish					
FLU 247	Japanese					
FLU 248	Chinese					

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses						
BMB 301	Genetics	3	-	-	3	
BMB 302	Microbiology	4	-	-	4	
BMB 303	Biochemistry & Metabolic Regulation	3	-	-	3	
BMB 304	Anatomy & Plant Physiology	3	-	-	3	
BMB 305	Animal Physiology-I	2	1	-	3	
BMB 306	Chemistry – III	3	-	-	3	
BMB 320	Biotechnology Lab – III	-	-	4	2	
BMB 321	Chemistry Lab – III	-	-	2	1	
BMB 322	Anatomy & Plant Physiology Lab	-	-	2	1	
BMB 323	Animal Physiology Lab-I	-		2	1	
BMB 330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**26**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 341	Communication Skill - III	30	-	-		
BSU 343	Behavioural Science - III	30	-	-		
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses						
BMB 401	Bioinformatics	3	-	-	3	
BMB 402	Molecular Cell Biology	3	-	-	3	
BMB 403	Immunology & Immunotechnology	4	-	-	4	
BMB 404	Plant Breeding, Embryology, Pathology & Economic Botany	3	-	-	3	
BMB 405	Animal Physiology-II	3	-	-	3	
BMB 406	Chemistry – IV	3	-	-	3	
BMB 420	Biotechnology Lab - IV	-	-	4	2	
BMB 421	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	2	1	
BMB 422	Animal Physiology Lab-II	-	-	2	1	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 441	Communication Skill - IV	30	-	-		
BSU 443	Behavioural Science - IV	30	-	-		
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

SUMMER TRAINING: 4 – 6 WEEKS

FIFTH SEMESTER

Compulsory Courses						
BMB 501	Plant Biotechnology	3	-	-	3	
BMB 502	Animal Biotechnology	3	-	-	3	
BMB 503	Genomics & Proteomics	3	-	-	3	
BMB 504	Recombinant DNA Technology	3	-	-	3	
BMB 520	Biotechnology Lab - V	-	-	4	2	
BMB 521	Genomics & Proteomics Lab	-	-	4	2	
BMB 550	Summer Training (Evaluation)	-	-	-		
	TOTAL				16	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 541	Communication Skill - V	30	-	-		
BSU 543	Behavioural Science - V	30	-	-		
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses						
BMB 601	Environmental Biotechnology	4	-	-	4	
BMB 602	Industrial Biology	4	-	-	4	
BCH 623	Principles of Management & Entrepreneurship Development	1	-	-	1	
BMB 620	Environmental & Industrial Biotechnology Lab	-	-	4	2	
BMB 660	Project (10-12 Week)	-	-	-	12	
	TOTAL				**23**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 641	Communication Skill - VI	30	-	-		
BSU 643	Behavioural Science - VI	30	-	-		
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

V. dastar

SEVEN SEMESTER

New Course Code	Course Title	Lecture (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits	Page No.
Compulsory Courses						
BMB701	Advanced Biochemistry	*3*	1	-	4	
BMB702	Advanced Microbial Technology	3	-	-	3	
BMB703	Biophysics & Bioanalytical Techniques	3	-	-	3	
BMB704	Advanced Cell Biology & Genetics	3	1	-	4	
BMB705	Advanced Biostatistics for Biologists	3	-	-	3	
CSE 703	Computer Applications	3	-	-	3	
BMB720	Biochemistry Lab	-	-	4	2	
BMB721	Advanced Microbial Technology Lab	-	-	2	1	
BMB 722	Cell Biology & Genetics Lab	-	-	2	1	
CSE 723	Computer Applications Lab	-	-	2	1	
	TOTAL				**25**	
Optional Courses - Value Added Courses; [Hours/Sem]						
BCP 741	Advanced Communication I	30	-	-		
BSP 743	Behavioural Science I	30	-	-		

EIGHT SEMESTER

Compulsory Courses						
BMB801	Advanced Molecular Biology	4	-	-	4	
BMB802	Advances in Genetic Engineering	4	-	-	4	
BMB803	Bioprocess Technology	4	-	-	4	
BMB804	Advanced Genomics & Proteomics	4	-	-	4	
BMB805	Computational Biology	3	-	-	3	
BMB806	Environmental Biotechnology	3	-	-	3	
BMB820	Advanced Molecular Biology Lab	-	-	4	2	
BMB821	Genetic Engineering Lab	-	-	4	2	
BMB822	Bioprocess Technology Lab	-	-	4	2	
BMB823	Advanced Genomics & Proteomics Lab			2	1	
BMB824	Computational Biology Lab	-	-	2	1	
	TOTAL				**30**	
Optional Courses - Value Added Courses; [Hours/Sem]						
BCP 841	Advanced Communicaion II	30	-	-		
BSP 843	Behavioural Science II	30	-	-		

SUMMER INTERNSHIP OF 09 -12 WEEKS

V. dastar

NINE SEMESTER

Compulsory Courses						
BMB901	Advanced Immunology	3	-	-	3	
BMB902	Enzyme Technology	3	-	-	3	
BMB903	Advanced Animal Biotechnology	3	-	-	3	
BMB904	Advanced Plant Biotechnology	3	-	-	3	
 BMB905 BMB906 BMB907 BMB908 BMB909 BMB910 BMB911	**Elective (Select any One)** • Drug Design & Development • Drug Delivery Systems • Pharmaceutical Biotechnology • IPR, Biosafety & Bioethics • Clinical Biotechnology • Nanobiotechnology • Entrepreneurship In Biotechnology	3	-	-	3	
BMB920	Advanced Immunology Lab	-	-	2	1	
BMB921	Enzyme Technology Lab	-	-	2	1	
BMB922	Advanced Animal Biotechnology & Plant Biotechnology Lab	-	-	2	1	
BMB950	Summer Internship (Evaluation)	-	-	-	12	
	TOTAL				**30**	

TENTH SEMESTER

Compulsory Courses						
BMB1060	Project (20 - 22 weeks)	-	-	-	30	
	TOTAL				**30**	

CELL BIOLOGY

Course Code: BMB 101 **Credit Units: 03**

Course Objective:

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the theories given by scientists for the origin of cell along with different types of prokaryotic and eukaryotic cells.
- Know the cellular structure of cell organelle and their functions.
- Differentiate between chromosomal structures in different stages of a cell cycle.
- Understand towards cell differentiation, malignancy and cell death.
- Develop verbal and written skills of subject along with interdisciplinary approach.

Course Contents:

Module I: Cell as a basic unit of living systems
The cell theory, precellular evolution; broad classification of cell types: archaebacteria, PPLOs, bacteria, eukaryotic microbes, plant – and animal cells; cell, tissue, organ and organisms, different levels of organization.

Module II: Ultrastructure of the cell membrane and cell organelles
Ultrastructure of cell membrane and function, Structure of cell organelles; golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules.), mitochondria, chloroplast, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus).

Module III: Chromosomes
Structural organisation of chromosomes, chromatids, centromere, telomere, chromatin, nucleosome organisations; eu-and heterochromatin.

Module IV: Cell division and cell cycle
Cell cycle, interphase, mitosis and meiosis

Module V: Cell – Cell interaction
Cell locomotion (amoeboid, flagellar and ciliar); cell senescence and death (apoptosis).

Module VI: Cell differentiation
Mechanism of cell differention (e.g., RBC) ;difference between normal and cancer cells.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Cell and Molecular Biology, DeRobertis, B.I. Publication Pvt. Ltd.
- Cell and Molecular Biology -Sheelar& Bianchi, John Wiley

References:

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Molecular Cell Biology, H.Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Cell Biology, Singh & Tomar
- The world of the cell – Becker ,Klinshmith& Harden, Pearson

MATHS AND BIOSTATISTICS

Course Code: BMB 102 **Credit Units: 03**

Course Objective:
The course involves a working understanding of tools of mathematical & statistical skills in the field of biology.

Course Contents:

MATHS

Module I: Bridge course
Set theory and properties of subsets, Binomial theorem of integer, logarithm (definition & laws of logarithm, use of log table), surds, square root & cube root,

Module II
Function, limits of functions, (basic idea of limits of functions without analytic definition), derivatives of functions, Matrices (Fundamental calculations and calculation of Eigen values) and Series

BIOSTATISTICS

Module III
Measure of central tendency and measure of dispersion
Probability (classical & axiomatic definition of probability, theorem on total and compound probability), Addition and Multiplication theorem of Probability, Random variables and Probability Distribution
Simple problems involving Binomial, Poisson and Normal variables,

Module IV
Correlation and regression,
Methods of sampling, collection of data: primary & secondary data, Probability Sampling and non Probability Sampling methods

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- Fundamental of Biostatistics, Bernard Rosner, Oxford University Press
- Mathematical Statistics, H.C. Saxena, S. Chand & Company

References:
- Introduction to Probability Theory, P.G. Hoel, Houghton Mifflin College
- Introduction to Statistical Theory, P.G. Hoel, S.C. Port, C.J. Schiller, R.A. Srinivasan, A. Srivasan, McGraw-Hill Trade
- Schaum's Outline of Probability, Random Variables and Random Processes, H.P. Hsu, McGraw-Hill Trade
- Statistics of Extremes, E.J. Gumbel, Columbia University Press

Plant Sciences - I

Course Code: BMB 103 **Credit Units: 03**

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Learning Outcome

1. The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways & mode of reproduction.
2. Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans.
3. Study and acquire knowledge about the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza.
4. Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes.

Course Contents:

Module I: Algae
Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi
Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:,*Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes
Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes
Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella, Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.
- A Text book of Algae, B. R. Vashishtha
- Bryophytes, N. S. Parihar
- Pteridophytes, N. S. Parihar
- An Introduction to Pteridophytes, A. Rashid.

Animal Sciences - I

Course Code: BMB 104 **Credit Units: 03**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Learning Outcome

After successful completion of the course student will be able to:

- Learn about characteristics and variations of invertebrates.
- Develop scientific outlook for research and innovation.
- Get knowledge of typical invertebrates and their economic importance.
- Develop conservative outlook for animals.
- Generate written and verbal communication skills over the subject.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.

-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:

-Protozoa: Type study of *Plasmodium.*

-Porifera: Type of *Sycon.*

Module III

-Coelnterata: Type study of *Ovelia.*

-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates

-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*

-Arthropoda: Type Study of *Prawn*

Module V:

Mollusca: Type Study of *Pila*

Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.
- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: BMB 105 **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Course Contents:

INORGANIC

Module I
Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II
Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III
Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV
Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V
Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases.

Module VI
Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd**.**
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – I
(BASED ON CELL BIOLOGY AND BIOSTATISTICS)

Course Code: BMB 120 **Credit Units: 01**

Course Contents:

Module I: Cell Biology
Cytological preparations, Fixation, dehydration and staining, Squash preparation of meiotic and mitotic cells, Embedding and sectioning.

Module II: Biostatistics
Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CHEMISTRY LAB - I

Course Code: BMB 121 **Credit Units: 01**

Course Contents:
INORGANIC CHEMISTRY
Module I
Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$
Module II
Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.
Module III
Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV
Determination of surface tension and viscosity of liquids

Module V
Heat of neutralisation of a strong acid and a strong base.

Module VI
Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Plant Sciences Lab - I

Course Code: BMB 122 **Credit Units: 01**

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Sciences Lab- I

Course Code: BMB 123 **Credit Units: 01**

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	End Term Examination
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha, Business Communication, Galgotia Publishing Company.***

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.
- Our natural resources including renewable and non-renewable resources comprising of forest,

water, mineral, food, energy and land resources.

- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**ESE**
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

This course aims at imparting an understanding of:

- Understanding self & process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and its effective on personality
- Building Emotional Competency

Course Contents:

Module I: Self: Core Competency **(2 Hours)**

- Understanding of Self
- Components of Self – Self identity
- Self concept
- Self confidence
- Self image

Module II: Techniques of Self Awareness **(2 Hours)**

- Exploration through Johari Window
- Mapping the key characteristics of self
- Framing a charter for self
- Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness **(2 Hours)**

- Meaning
- Importance
- Components of self esteem
- High and low self esteem
- Measuring your self esteem

Module IV: Building Positive Attitude **(2 Hours)**

- Meaning and nature of attitude
- Components and Types of attitude
- Importance and relevance of attitude

Module V: Building Emotional Competence **(2 Hours)**

- Emotional Intelligence – Meaning, components, Importance and Relevance
- Positive and negative emotions
- Healthy and Unhealthy expression of emotions

Student learning outcomes

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-I

CourseCode: FLU144 **Creditunits: 02**

CourseObjective:
Tofamiliarize studentswiththeFrenchlanguage,withitsphonetic systemanditsaccents.
Toenable students

- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone’sfamily,tastes andpreferences

CourseContents:
Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:
S’adresserpolimentàquelqu’un,entrerencontact,seprésenter,présenterquelqu’un,saluer,poserdesquestions
simplespourconnaître quelqu’un,épeleret compter
Dossier2:EnfamilleActesdeCommunication:
Parler de sa famille, Décrire quelqu’un, exprimer ses goûts, écrire et comprendre un message court, inviter
quelqu’un,exprimerla possession,la négation
Grammaire :
1. articles indéfinis,articlesdéfinis, masculinetféminindesnomset desadjectifs,pluriel desnomset desadjectifs
2. pronomssujetsettoniques,on,c’est/il est+ profession,
3. masculinet fémininde sadjectifsdenationalité
4. verbes-être,avoir,aller,‘er’groupe
5. l’interrogation–l’intonation,est-ce que,quiest-ce ? Qu’est-ce que? L’inversion; où,comment,quand; quel
6. la négation
7. adjectifspossessifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
· Andant,Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
· Andant,Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.
Références:
· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

INTRODUCTORY BIOCHEMISTRY AND BIOPHYSICS

Course Code: BMB 201 **Credit Units: 04**

Course Objective:

Basics in Biochemistry and Biophysics will be taught to the students in the first year itself, which will act as a foundation for all further courses in Biotechnology. The students will be familiarized with structures and functions of biomolecules and basic energetic that governs the biological reactions.

Learning Outcome:

After successful completion of the course student will be able to:

* Get familiarize with structures and functions of biomolecules like Carbohydrates, Fats and Nucleic Acids.
* Understand the role of covalent and non-covalent bonds, inter-and intramolecular interactions and their contribution to the native conformation of biomolecules.
* Know the molecular transport within the cell and across membranes and get familiar with the different laws of Physics that are valid in biological systems.
* Calculate energy changes in biological pathways, understand mechanism of light and sound reception.
* Understand how electricity can act as potent signal as well the role of neurotransmitters.

Course Contents:

Module I: Nature of Biological materials
carbohydrates, lipids, proteins,, nucleic acids; oxidation-reduction properties, pH, pK and buffering, hormones and growth factors. High energy biomolecules ATP, GTP & Creatine phosphate.

Module II: Perspectives of biological macromolecules
Types of chemical bonds, hydrophilic and hydrophobic groups in biomolecules, repeating units in proteins and nucleic acids, Basis for intermolecular interaction with examples.

Module III: Bio-energetic
Laws of thermodynamics (1^{st}& 2^{nd} laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.

Module IV: Energetic of a living body
Primary events in photosynthesis; strategies of light reception in microbes, plants and animals. Correction of vision faults, generation and reception of sonic vibrations.

Module V: Electrical properties of biological compartments
Electricity as a potential signal**,** Neurotrasmitters,Intra and intermolecular interactions in biological system Spatial and charge compatibility as determinant of such interactions.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Outline of Biochemistry, Conn &Stumph
- Fundamentals of Biochemistry, J.L. Jain
- Cellular Biophysics I & II, Thomas F. Weiss, 1995 MIT Press
- Basic Biophysics for Biology, E.K. Yeargers, 1992, CRC Press

References:

- Textbook of Biochemistry, Lehninger
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Instant notes in Biochemistry, Hames & Hooper
- Anatomy and Physiology – Tortora & Grabowski
- Biochemistry -Voet&Voit

BIOANALYTICAL TECHNIQUES

Course Code: BMB 202 **Credit Units: 03**

Course Objective:

The student will be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the principle and instrumentation of Colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, etc.
- Understand principle instrumentation of chromatographic techniques and their types.
- Principle and applications of electrophoresis I.e., PAGE, Immunoelectrophoresis etc.
- Understand radioisotope tracer techniques and application.
- Develop broad knowledge base, deep theoretical understanding of instruments and their practical implementation in the laboratory

Course Contents:

Module I: Instruments, basic principles and usage
pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography, Circular Dichorism.

Module II: Chromatography techniques
Paper chromatography, thin layer chromatography, affinity chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography,

Module III: Electrophoresis
Agarose gel electrophoresis, SDS polyacrylamide electrophoresis, immunoelectrophoresis, Isoelectric focussing.

Module IV: Radioisotope tracer techniques and autoradiography

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
- Bioinstrumentation, Webster

References:

- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
- Crystal Structure Analysis, J.P. Glusker and K.N. Trueblood, Oxford University Press
- Modern Spectroscopy, J.M. Hollas, John Wiley and Son Ltd.
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, H. Gunther, John Wiley and Sons Ltd.
- Principles of Physical Biochemistry, K.E. Van Holde, Prentice Hall.
- Principles and Practice of Bioanalysis, Richard F. Venn
- Microscopic Techniques in Biotechnology, Michael Hoppert
- Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker, S.J. Hall

PLANT SCIENCES - II

Course Code: BMB 203 **Credit Units: 03**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Learning Outcomes:

1. The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm.
2. The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms.
3. The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms.
4. Know the economic importance of the angiosperm plants.
5. Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas*, *Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

ANIMAL SCIENCES-II

Course Code: BMB 204 **Credit Units: 03**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge about Chordates.
- Learn about comparative account of vertebrates.
- Learn about anatomical & physiological variability among vertebrates.
- Generates interdisciplinary and collaborative approach.
- Develops ethical and conservative outlook for animals.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: BMB 205 **Credit Units: 03**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Course Contents:

ORGANIC CHEMISTRY

Module I

Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II

Petroleum: Fractionation, cracking and synthetic petrol.
General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III

Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV

Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V

Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India.

BIOTECHNOLOGY LAB – II (BASED ON INTRODUCTORY BIOCHEMISTRY, BIOPHYSICS AND BIOANALYTICAL TECHNIQUES)

Course Code: BMB 220 **Credit Units: 01**

Course Contents:

Module I: Biochemistry
Preparation of buffer, Colour reactions of Carbohydrates, Colour reactions of amino acids, Extraction of lipids, Estimation of protein by Bradford method.

Module II
Paper chromatography of sugars, Amino Acids, Plant pigments.
Use of spectrophotometer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BMB 221 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg^{2+}, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH^{1+}, K^{1+}, CO^{2-}, S^{2-}, SO^{2-}, NO^{1-}, $CH COO^{1-}$, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO^{1-}, SO^{2-}, $C O^{2-}$, PO^{3-}, BO^{3-}.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT SCIENCES LAB - II

Course Code: BMB 222 **Credit Units: 01**

Course Contents:

Module I: Gymnosperm
Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations.

Module II: Taxonomy
Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: BMB 223 **Credit Units: 01**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear Different types of important edible fishes of India .Study of specimens and slides related to Chordates should be added

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*
Alan Pease : Body Language

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**
Total Hours: 10

Course Objective:

This course aims at enabling students towards:

- Understand the importance of individual differences
- Better understanding of self in relation to society and nation
- Facilitation for a meaningful existence and adjustment in society
- Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

- Personality: Definition& Relevance
- Importance of nature & nurture in Personality Development
- Importance and Recognition of Individual differences in Personality
- Accepting and Managing Individual differences
- Intuition, Judgment, Perception & Sensation (MBTI)
- BIG5 Factors

Module II: Managing Diversity

- Defining Diversity
- Affirmation Action and Managing Diversity **(2 Hours)**
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

Module III: Socialization **(2 Hours)**

- Nature of Socialization
- Social Interaction
- Interaction of Socialization Process
- Contributions to Society and Nation

Module IV: Patriotism and National Pride **(2 Hours)**

- Sense of pride and patriotism
- Importance of discipline and hard work
- Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

- Meaning and Importance of human rights
- Human rights awareness
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

▪Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions

▪Student will be able to understand and respect individual difference, so to enhance the relationship ▪Learn social responsibility and develop a sense of citizenship

▪Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

•Davis, K. Organizational Behaviour,
•Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour
•Dressler, David and Cans, Donald: The Study of Human Interaction
.•Lapiere, Richard. T – Social Change
•Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
•Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. Robbins O.B.Stephen;.
Organizational Behaviou

Français-II

CourseCode: FLU244 **Creditunits: 02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

CourseContents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:

Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessportsetdes loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:

Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,compareret exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

GENETICS

Course Code: BMB 301 **Credit Units: 03**

Course Objective:

The objective of the course is to focus on the basic principles of genetics incorporating the concepts of classical, molecular genetics. Compilation is required for recent advances in genetic principles for strong foundation in Biotechnology. The objective of the course is to focus on basic principles of inheritance

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the concept of classical genetics including Mendelian laws is easily grasped by students.
- Understand the basic microbial genetics including prokaryotic gene expression and regulation.
- Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept.
- Know various chemical and physical mutagens involved in causing mutation.
- Understand the concept of sex determination and populations genetics.

Course Contents:

Module I

Brief history, scope and significance of Genetics. Mendelian law of inheritance.Lethality and interaction of gene.Multiple allele and isoallele.Penetrance and Expressivity .Linkage and crossing over. Mapping of genes .interference and coincidence.

Module II

Basic microbial genetics, Conjugation, transformation, transduction and their use in genetic mapping.

Module III

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module IV

Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module V

Sex determination in plant and animal. Non disjunction as a proof of chromosomal theory of inheritance. Sex linked, sex influenced and sex limited inheritance.

Module VI

Extra chromosomal inheritance; cytoplasmic inheritance, Mitochondrial and Chloroplast genetic system.

Module VII

Population genetics; Hardy-Weinberg equilibrium law, Gene and genotype frequencies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.
- Genetics, R. Goodenough, International Thomson Publishing.
- Introduction to Genetic Analysis, A.J. F. Griffiths, W.H. Freeman and Company.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.
- Molecular Biology of the Gene (Fifth Edition), J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison – Wiesley Publishing.

MICROBIOLOGY

Course Code: BMB 302 **Credit Units: 04**

Course Objective:

The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the microbiological techniques for the isolation and characterization of microbes.
- **Understand the mechanism of different metabolic processes.**
- Know the physiology and survival mechanism of extremophilic bacteria.
- Know the concept of virus lytic and lysogenic cycle is quite clear to students.
- **Understand the epidemiology and microbial pathogenesis.**

Course Contents:

Module I

Introduction and historical perspective -Discovery of the microbial world, controversy over spontaneous generation, role of microorganisms in transformation of organic matter and in the causation of diseases, development of pure culture methods. Methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization,

Module II

Prokaryotic structure and function - functional anatomy of bacteria: cell envelope, cell wall, cytoplasmic membrane, capsule, surface appendages, cytoplasm and cytoplasmic inclusions. Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth, synchronous growth, continuous culture, culture collection and maintenance of cultures.

Module III

Systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Module IV

Metabolic Diversity among microorganisms- photosynthesis in microorganisms, role of bacteriochlorophylls, carotenoids and phycobilins, Chemolithotrophy, hydrogrn-iron-nitrite-oxidizing bacteria, nitrate and sulphate reduction, methanogenesis and acetogenesis, Fermentations, nitrogen fixation, plant microbe interactions (mycorrhizae).

Module V: Archaea

Archae as earliest life forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles Viruses: Bacterial, animal; structure of viruses; Reproduction and life cycle of RNA and DNA viruses; Viroids and prions. Algae and Fungi: Classification and Reproduction.

Module VI

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract, Respiratory infections; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions,Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission; Sexually transmitted disease including AIDS, Food and water- borne diseases; pathogenic fungi.

Module VII

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antifungal antibiotics; mode of action.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- General Microbiology, R.Y. Stanier, J.L. Ingraham, M.L.Wheelis and P.R. Painter, Macmillian
- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing, Benjamin Cummings.

References:

- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin & Cummings
- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Books Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers Principles of Microbiology, R.M. Atlas, WMC. Brown Publisher.

BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: BMB 303 **Credit Units: 03**

Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge of biochemical aspects of body.
- Learn about important metabolic pathways and their regulation.
- Deals with pathways responsible for energy production.
- Study of various enzymatic reactions and their role in body.
- Develops collaborative and research approach.

Course Contents:

Module I

Carbohydrate metabolism-glycolysis pathway and reactions, Glycogen breakdown and synthesis, control of glycogen metabolism, glycogen storage and its diseases, Citric acid cycle -Overview, Metabolic sources of Acetyl Co-A, enzymes and regulation, The amphibolic nature of the Citric acid cycle Electron transport chain and oxidative photophosphorylation -mitochondria and electron transport, phosphorylation and control of ATP production Gluconeogenesis, The glyoxylate pathway, Pentose phosphate pathway

Module II

Lipid metabolism - fatty acid oxidation, ketone bodies, fatty acid biosynthesis, regulation of fatty acid metabolism.

Module III

Amino acid metabolism -Amino acid deamination, urea cycle, amino acids as biosynthetic precursors, biosynthesis of amino acids, Nitrogen fixation

Module IV

Nucleotide Metabolism -structure and metabolism of purines and pyrimidines,

Module V

Classification and nomenclature of enzymes, regulation of enzyme activity, coenzymes-structure and function of coenzyme A; kinetics of enzyme catalyzed reactions; isolation and purification of enzymes ; enzymes in food processing, medicines and production of chemical compounds

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Harper's Illustrated Biochemistry, Robert, K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, McGraw-Hill
- Biochemistry, L. Stryer, W.H. Freeman and Company
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.

References:

- Cellular Biophysics I & II, Thomas F. Weiss 1995, MIT Press
- Biochemical calculations, I.H. Segal. Publisher, John Wiley and Sons
- Biochemistry, C.K. Mathews, K.E. Van Holde and K.G. Ahern, Benjamin / Cummings.
- Devlin's Textbook of Biochemistry with Clinical correlations, John Wiley and Sons Inc.
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing.

ANATOMY & PLANT PHYSIOLOGY

Course Code: BMB 304 **Credit Units: 03**

Course Objective:

The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Learning Outcomes:

1. The students will be conceptually integrated to plant internal structure & their functions
2. Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants.
3. The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation.
4. The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students.
5. The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.

Course Contents:

Module I

Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviourof cambium in *Achyranthes, Boerhaavia, Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II

Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III

Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV

Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:

- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: BMB 305 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.
Learning Outcomes:
After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Gain knowledge about functioning of systems of body.
- Generate path for further research and innovation.
- Enhance new collaborative approaches with modern fields of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BMB 306 **Credit Units: 03**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

BIOTECHNOLOGY LAB – III

Course Code: BMB 320 **Credit Units: 02**

Course Contents:

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation

Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human

Module III
Aseptic techniques:
Cleaning of glassware
Preparation of media, cotton plugging and sterilization.

Module IV
Isolation of microorganisms from air, water and soil samples: dilution, pour plating and colony purification.
Enumeration of microorganisms: total vs. viable counts.

Module V: Biochemistry
Estimation of DNA, Estimation of RNA, Estimation of sugar in given solution, Assay of enzyme activity – amylase,

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BMB 321 **Credit Units: 01**

Course Contents:

INORGANIC CHEMISTRY

Module I
Gravimetric estimation of barium and SO^{2+} as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II
Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BMB 322 **Credit Units: 01**
Course Contents:

Module I: Physiology
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.
Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.
Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)
Experimentation- Separations of photosynthetic pigments by thin layer chromatography.
Respiration – Determination of R.Q.
Module II: Plant Anatomy
Anatomy of normal dicot and monocot roots, stems & leaves
Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BMB 323 **Credit Units: 01**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **CreditUnits: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I** **Principles of Effective Writing**	**35%Weightage**
	• Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	
2.	**Module II** **Formal Letter Writing**	**35% Weightage**
	• Block Format • Types of Letters • E-mail • Netiquette	
3.	**Module III** **Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV** **Short Stories**	**10%Weightage**
	• Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 Course Credit: 01

Course Objective:
To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:
Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999 •Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998. •Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage,
sesituerdanslemonde,exprimerletemps(avecindicateursde
temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.

TERM PAPER

Course Code: BMB 330 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.

b) Begin by making a list of subject-headings under which you might expect the subject to be listed.

c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.

b) In research studies, notice the methods and procedures, results & conclusions.

c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.

b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose

b) main body of the paper

c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.

b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.

c) Check for proper spelling, phrasing and sentence construction.

d) Check for proper form on footnotes, quotes, and punctuation.

e) Check to see that quotations serve one of the following purposes:

   (i) Show evidence of what an author has said.

   (ii) Avoid misrepresentation through restatement.

   (iii) Save unnecessary writing when ideas have been well expressed by the original author.

f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.
The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.
The key to a good bibliography is consistency. Choose a particular convention and stick to this.
[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C." Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network" IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.
[2] Shazia Karim, Imran Sarwar Bajwa,"Clinical Decision Support System based Virtual Telemedicine"2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada "Intelligent Management of Processes in a ICU Telemedicine System" Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%
(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%
(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

BIOINFORMATICS

Course Code: BMB 401 **Credit Units: 03**

Course Objective:

The course involves a basic understanding of computer and bioinformatics tools and skills in the field of biology.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the structural organization and characteristics of computers and its parts.
- Describe the concept of use of internet in bioinformatics.
- Explain the concept and organization of biological databases.
- Understand and explain the structure and functions of the phylogenetic analytic tools.
- Interrogate major database sources and be able to integrate this information with clinical data.

Course Contents:

Module I: Computers

General introduction (characteristics, capabilities, generations), software, hardware : organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), interpreter, compiler, data processing; batch, on-line, real-time (examples from bioindustries; e.g. application of computers in co-ordination of solute concentration, ph, temperature, etc., of a fermenter in operation); internet application.

Module II: Basic Bioinformatics

Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Module III: Biological Databases

Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Module IV: Phylogenetic Analysis

Trees-splits and metrices on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software.

Module V: Genome analysis

Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Computer Science, J.G. Brookshear, Pearson, Addison Wesley
- Introduction to Bioinformation – T.Attawood

References:

- A book on C by Kelley : Programming in C, Addison-Wesley Publishing
- Introduction to C++ for Engineers and Scientists, Prentice-Hall
- Schaum's Outline of Introduction of Computer Science, P. Cushman and R. Mata-Toledo, McGraw Hill Trade
- Bioinformatics – Managing Scientific Data, Zoe' Lacroix and Terence Critchlow
- Bioinformatics – Sequence, Structure and Databanks, Des Higgins & Willie Taylor
- Structural Bioinformatics, Philip E. Bourne, Helge Weissig 2003
- Statistical Methods in Bioinformatics: An Introduction, G.R. Grant, W.J. Ewens, Springer Verlag

MOLECULAR CELL BIOLOGY

Course Code: BMB 402 **Credit Units: 03**

Course Objective:

The aim is to extend understanding of the molecular mechanisms via which genetic information's are stored, expressed and transmitted among generations.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop deep understanding of DNA/ RNA structure, and mechanism of DNA replication.
- Understand Genetic Codes and Transposable elements
- Understand mechanism of transcription and translation in prokaryotes and eukaryotes.
- Enhance fine molecular understanding of operon gene regulation ion in prokaryotes.
- Understand the mechanism of Oncogenes and Tumor suppressor genes.

Course Contents:

Module I: Introduction to Moleculer Biology,
Structure and composition of DNA, RNA structure and its types, Basic techniques in molecular biology (Agarose gel electrophoresis, PCR etc.) and its applications.
Molecular basis of life:DNA replication in prokaryotes and eukaryotes; DNA recombination molecular mechanisms.
Module II:Insertion elements, transposons and retrotransposons
Mobile genetic elements and its types in both prokaryotes and eukaryotes and their applications.
Application of genetic engineering
Organisation of genetic material: Split genes; overlapping genes; pseudogenes; cryptic genes
Genetic Code: Properties of genetic code, codon assignment, chain termination codons, wobble hypothesis.
Module III: Structure of prokaryotic and eukaryotic genes
Transcription mechanism in prokaryotes and eukaryotes.
Translation : Translation mechanisms in prokaryotes and eukaryotes.
Module IV: Gene Expression in prokaryotes
Operon concept, Positive and Negative control of operon (Lac, Tryptophan and Arabinose operon)
Module V:Eukaryotic geneExpression
Overview of gene expression, polyadenylation, cap formation, RNA degradation.
Module VI: Oncogenes and Tumor Suppressor genes
Oncogenes, tumorsuppressor genes in humans, role of genes in cancer development.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson,
- Garland Publishing.

References:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education
- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D.Baltimore and J.E. Barnell, W. H Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

IMMUNOLOGY & IMMUNOTECHNOLOGY

Course Title: IMMUNOLOGY & IMMUNOTECHNOLOGY **Credit Units: 03**
Course Level: UG Level **Course Code: BMB 403**

Course Objectives:
Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.
Course Contents/Syllabus:

	Weightage (%)
Module I :	
Historical perspective of immune system and immunity; Innate and specific immunity. Humoral immunity, Cell-mediated immunity and Clonal selection theory. The organs: Primary and secondary lymphoid organ. Hematopoiesis and regulation. Cells of the immune system: granulated and agranulated cells.	20 %
Module II:	
Histocompatibility: structure of MHC class I, II & III Antigens & their mode of antigen presentation MHC restriction. Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Genetic basis of antibody diversity. Antibodies in targeting therapeutic agents. Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application.	20 %
Module III :	
Measurement of antigen – antibody interaction: Affinity, Avidity, cross reactivity, Agglutination, Precipitation Immunodiffusion, Immuno-electrophoresis, ELISA, RIE, Western blotting, Fluorescent antibody techniques	20 %
Module IV :	
Immunity to infections of diseases; vaccines (attenuated and recombinant) and vaccination. Autoimmunity and autoimmune diseases: Hashimoto's thyroiditis; Myasthenia gravis; Rheumatoid Arthritis, Pernicious anemia, Asthma Hypersensitivity- type I, II, III, and IV hypersensitivity Tissue and organ transplantation	20 %
Module V :	
Immunoinformatics: Immunomics B cell and T cell databases. Webservers and tools for prediction of B-cell epitopes, T-cell epitopes, allergy and *in-silico* vaccine designing. Introduction of immunophysics techniques and applications.	20%

Student Learning Outcomes:
Having successfully completed this course, students will be able to:
- Understand and explain the phylogeny of immune system, types of immunity, immune response.
- Describe the concept of clonal selection theory, humoral and cell mediated immunity.
- Understand and explain the structure and functions of the organs and cells of the immune system.
- Understand the mechanism of antigen-antibody interaction.
- Describe the structure of antibodies, their types and functions in immunity.

Pedagogy for Course Delivery:

- Students are encouraged to engage in active interaction during lecture through discussion and questions.
- Power point presentation and class room lecture.

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable: NA

Assessment/ Examination Scheme:

Components	**Mid Term**	**Assignment/ Project/Seminar/Quiz**	**Attendance**	**End Term**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Freeman

References:

- Immunology, Roitt, Mosby – Yearbook Inc.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
- Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell).
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BMB 404 **Credit Units: 03**

Course Objective:
To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Learning Outcomes:

1. The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view.
2. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation.
3. The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products.
4. The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them.
5. The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

Course Contents:

Module I
Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.

Module II
Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding

Module III
General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.

Module IV
Economic importance with special reference to plants yielding:
a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
b) Common fibre yielding plants - Cotton, Jute .
c) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
d) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BMB 405 **Credit Units: 03**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Understands functioning of important systems of body.
- Develops knowledge about endocrinology and developmental biology.
- Leads to enhance interest in research in advanced biotechnology.
- Exposure with other interdisciplinary subjects of biology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals

- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:

- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:

- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization
-

Module IV:Developmental Biology:

- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York Shier, D., Butler, J. and Lewis, R., Hole"s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: BMB 406 **Credit Units: 03**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic &non aromatic compounds and their uses.

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates
Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II
General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III
General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV
Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics
Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry
Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry
Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:
- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:
- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

BIOTECHNOLOGY LAB – IV
(BASED ON BIOINFORMATICS, MOLECULAR CELL BIOLOGY, IMMUNOLOGY)

Course Title: BIOTECHNOLOGY – IV LAB **Credit Units: 01**
Course Level: UG **Course Code: BMB 420**

Course Contents/Syllabus:

	Weightage (%)
Module I: Computers	25%
Handling of computers and Protein and nucleotide sequence retrieval and analysis using different databases	
Module II: Bioinformatics	25%
Pubmed searching, Entrez (meta search engine), Phylogenic software – Phylip , Sequence analysis tools, Multiple sequence analysis Clustal W.	
Module III	25%
Isolation of nuclear DNA (genomic & plasmid DNA) and Agarose gel electrophoresis	
Module IV	25%
Blood film preparation &identification of blood cells Study of blood groups Study of ELISA.	

Pedagogy for Course Delivery:
Laboratory instructions
Methodology discussion
Hands on experiments
Data collection

List of Professional Skill Development Activities (PSDA): If applicable

Lab/ Practical details, if applicable:

Assessment/ Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY LAB

Course Code: BMB 421 **Credit Units: 01**

Course Contents:

Module I: Embryology
Study of permanent slides of the**:**
a) T.S. anther, pollen, germinating pollen
b) L.S. ovule types
c) Endosperm
d) Embryos
e) L.S. caryopsis
f) Dissection of embryo

Module II:Plant Pathology
Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany
Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code: BMB 422 **Credit Units: 01**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland
- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.
- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:
This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: *Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: *Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.*
Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building-"New Self awareness.

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.

Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten
Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready
Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulotActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl'imparfait,comparer(nometverbe),qualifier(qui,que)s' exprimer
autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. l'imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND TOTAL**
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant, Christineet al.<u>A proposA1Livre del'élève</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.
- Andant, Christineet al.<u>A proposA1Cahierd'exercices</u>.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:

- Girardeau, Brunoet NellyMous.<u>Réussirle DELFA1</u>

PLANT BIOTECHNOLOGY

Course Code: BMB 501 **Credit Units: 03**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation.

Learning outcomes:

After successful completion of the course student will be able to:

- Handle the basic instruments used in plant biotechnology.
- Learn Preparation of stocks for culture media.
- Learn surface sterilization of different explants
- Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab.
- Get training of problems related to germination, callus induction and propagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

ANIMAL BIOTECHNOLOGY

Course Title: ANIMAL BIOTECHNOLOGY — Credit Units: 3
Course Level: UG Level — Course Code: BMB-502

Course Objectives:
The application of Animal Biotechnology covers major areas related to commercial applications. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.
Pre-requisites: The students must possess fair understanding of ……………………………..
Course Contents/Syllabus:

	Weightage (%)
Module I	20%
Historical perspectives, sterilization methods, organ culture - culture techniques, plasma clot, raft methods, agar gel, grid method, organ engineering. Cell-culture substrates, cultural media, natural and artificial media, initiation and maintenance of cell cultures, cell culture products, cryopreservation techniques, immobilized cultures.	
Module II	15%
In-Vitro Fertilization (IVF) and Embryo Transfer Technology (ETT).	
Module III	20%
Somatic cell hybridization, Hybridoma technology and Production of Monoclonal antibodies.	
Module IV	20%
Animal genetic engineering -vectors, gene transfer methods - microinjection, virus mediated and other methods of gene transfer, Transgenic animals with new traits, transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic etc. Bioethical issues related to animal biotechnology.	
Module V	15%
Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).	
Module VI	10%
Fundamentals of Stem cell based therapy, Regenerative medicines	

Student Learning Outcomes:

- Concepts of animal biotechnology and its commercial applicability
- Understand sterilization techniques, understanding of organ culture.
- Learn methods of animal cell culture and maintenance and immobilization techniques.
- Understand concepts in-vitro fertilization and embryo transfer for live stock improvement.
- Become familiar with concept of somatic hybridization and transgenic technology.

Pedagogy for Course Delivery: Classroom lecture and power point presentation. Students are encouraged to engage in active interaction during classroom discussion on topic.

List of Professional Skill Development Activities (PSDA): If applicable

Assessment/ Examination Scheme:

Components	Mid Term	Assignment/ Project/Seminar/Quiz	Attendance	End Term
Weightage (%)	15	5	10	70

Text & References

- Cell Culture LabFAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

GENOMICS& PROTEOMICS

Course Code: BMB 503 **Credit Units: 03**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Gain understanding of basic structure of protein and its separation by using various techniques.
- Get insight of modeling and *in silico* protein structure building.
- Get understanding of study of protein – protein interaction using various methods.

Course Contents:

GENOMICS

Module I

The origin of genomes.
Acquisition of new Genes.
DNA sequencing-chemical and enzymatic methods.
The origins of introns.
Restriction mapping .

Module II

DNA & RNA fingerprinting.
The Human Genome.
Phylogeny.
SAGE, ESTs, AFLP & RFLP analysis.

PROTEOMICS

Module III

Basic principles of protein structure.
Analysis of Proteome :2D – gel electrophoresis, mass spectroscopy.

Module IV

Modeling of three-dimensional structure of a protein from amino acid sequence.
Modeling mutants.
Designing proteins.
Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Protein – protein interactions : Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes & proteomics From protein sequence to function - S R Pennington & M. J. Dunn

References:

- Bioinformatics: From Genomes to Drugs, T. Lengauer, John Wiley and Sons Inc.
- Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press
- DNA Micro arrays: A Practical Approach, M. Schlena, Oxford University Press.
- Genomes II, T.A. Brown
- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- Essential of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Proteomics, T. Palzkill, Kluwer Academic Publishers
- Statistical Genomics: Linkage, Mapping and QTL Analysis, B. Liu, CRC Press.

RECOMBINANT DNA TECHNOLOGY

Course Code: BMB 504 **Credit Units: 03**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes can be obtained through the course.

Learning Outcomes:

After successful completion of the course student will be able to:
* Learn the procedure of DNA isolation from bacteria, plant and animal cell and its purification and modification.
* Know various methods of introducing DNA into living cells.
* Learn the technique of gene cloning, tools used in it and different vectors used for transforming host cells.
* Know the procedure of producing proteins from cloned genes, its uses in medicines with examples and gene therapy.
* Learn the theoretical aspects of DNA amplification using PCR and analysis of DNA by various molecular markers.

Course Contents:

Module I
Isolation and purification of plasmid DNA, Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Module II
Methods of DNA Introduction into living cells.

Module III
Introduction to gene cloning and its uses, tools and techniques: plasmids and other vectors, DNA, RNA, cDNA.

Module IV
Production of proteins from cloned genes: gene cloning in medicine (Pharmaceutical agents such as insulin, growth hormones, recombinant vaccines), gene therapy for genetic diseases.

Module V
Analysis of DNA by Southern blotting, Analysis of RNA by Northern blotting, Analysis of proteins by Western blot techniques, Dot blots and slot blots, RFLP, AFLP.
PCR: Basic principles and its modification application and uses.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Gene cloning and DNA analysis by T.A. Brown

References:
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
- DNA Science by MicklosFreyer
- Principles of Gene manipulation and Genomics by Primrose and Twyman

BIOTECHNOLOGY LAB – V(BASED ON ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY AND MICROBIAL TECHNOLOGY)

Course Code: BMB 520 **Credit Units: 02**

Course Contents:

Module I
Sterilization techniques of glass wares &equipments.
Preparation of cotton plugs & culture media .
Preparation and sterilization .of different explants.
Inoculation of explants on culture media.

Module II
Culture of plant embryos/seeds.Callus culture, Testing of seed viability.

Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

Module IV
Identification of isolated bacteria: Gram staining methods, metabolic characterisation (IMVIC) test.
Growth curve of microorganisms
Antibiotic sensitivity of microbes, use of antibiotic discs.
Testing water quality (BOD, COD &*E. coli* count)

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENOMICS AND PROTEOMICS LAB

Course Code: BMB 521 **Credit Units: 02**

Course Contents:

Module I
Electrophoretic separation of plasmid DNA.
Restriction, digestion & ligation of DNA.

Module II
Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.

Module III
Comparison of two given genomes- Mummer.

Module IV
Homology modeling of 3-D structure from amino acid sequence: SWISS- MODELLER
Graphics tools: SWISS- PDB Viewer.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary** • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	**35% Weightage**
2.	**Module II Comprehension Skills** • Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	**25% Weightage**
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in Presentation Skills • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.
Effective English for Engineering Students, B Cauveri, Macmillan India
Creative English for Communication, Krishnaswamy N, Macmillan

Reference: *A Textbook of English Phonetics*, Balasubramanian T, Macmillan

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 | **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

_ narratingevents inthe past, markingthestages, usingappropriateconnectors
_ expressingcausesandconsequences, usingappropriate logical connectors
_ presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensembleActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement ,
l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

SUMMER TRAINING (EVALUATION)

Course Code: BMB 550 **Credit Units: 05**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and software's, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures
Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings
All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations
The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI
Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**
- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

- This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report:	50
Viva Voce:	50
Total:	**100**

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BMB 601 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with different processes and use of microbial technology that can be employed for a cleaner environment. The course also aims to make the students aware of legislation and rules prevalent to control the degradation of our environment.

Learning Outcomes:

After successful completion of the course student will be able to:

- Understand the delicate interrelationship of different components of environment.
- Understand conventional fuels, their impact and concept of clean fuel technology.
- Learn approaches and concepts behind bioremediation xenobiotic compounds, mechanism of microbial leaching and mining.
- Learn the concept of municipal solid and liquid wastes management and EIA.
- Understand the concept and assessment of environmental quality.

Course Contents:

Module I
Environmental components, Environmental pollution and its types, Non-renewable and renewable energy resources.

Module II
Conventional fuels and their major impacts: Global warming and greenhouse effect, Global Ozone Problem, Acid rain, Eutrophication, Biomagnification, Concept of clean fuel technology: Biomass energy and biofuels

Module III
Biodegradation of Xenobiotic compounds i.e. oil, pesticide and PAHs and bioremediation of major pollutants
Biomineralisation: Use of microbial technology for mining

Module IV
Treatment of municipal solid and liquid wastes
Environmental impact assessment and Environmental audit

Module V
Bioassessment of Environmental Quality,
Biofertilizers and Biopesticides

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology, Milton Wainwright
- Principles of Environmental Engineering, Gilbert Masters
- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial Microbiology – Cassida
- Agricultural Biotechnology – S.S. Purohit
- Wastewater Engineering – Metcalf & Eddy.

INDUSTRIAL BIOLOGY

Course Code: BMB 602 **Credit Units: 04**

Course Objective:

The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Learning Outcomes:

Upon completion of the course, students will be able to:

- Develop an understanding of the various aspects of Bioprocess Technology.
- Develop skills associated with screening of Industrially Important Strains and media formulation for industry.
- Understand principles underlying design of fermentor, fermentation process and downstream processing
- Develop an understanding of the various aspects of dairy Technology.
- Understand principles underlying immobilization and their application.

Course Contents:

Module I

Introduction to industrially important microbes, Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Module II

Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Module III

Microbial fermentative products, Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, food products from microbes (Dairy &SCP etc)

.

Module IV

Production of fermented dairy products

Module V

Immobilized enzymes systems, production and applications.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Industrial Microbiology – Cassida

References:

- Principles of fermentation Technology, Salisbury, Whitaker and Hall
- Industrial microbiology – Prescot &Duhn.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.
The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY LAB

Course Code: BMB 620 **Credit Units: 02**

Course Contents:

ENVIRONMENTAL BIOTECHNOLOGY

Module I
Symptomological studies of the impacts of conventional fuel
Comparative and statistical analysis of the pigment content due to air pollution.

Module II
Comparative and statistical analysis of the sugar content as an impact of air pollution
NR activity estimation and its statistical analysis under pollution stress conditions.

INDUSTRIAL BIOTECHNOLOGY

Module III
Production & downstream processing of alcoholic fermentation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:

1.	**Module I Social Communication Essentials** • Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	**30% Weightage**
2.	**Module II Workplace Interpersonal Skills** • Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	**25% Weightage**
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose** • Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	**10% Weightage**
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			End Term Examination
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:
i) express their sentiments, emotions and opinions, reacting to information, situations;
ii) narrate incidents, events;
iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation
I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BMB 660 **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student’s Name; Course; Year; Supervisor’s Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.2 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.2.1 Sub-Heading
(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.2 (a) Subsections under Sub-Heading
(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis
Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**

ADVANCED BIOCHEMISTRY

Course Code: BMB 701 **Credit Units: 04**

Course Objective:

Objective of this course is to help students navigate the discipline of biochemistry that explains how the collection of inanimate molecules that constitute the living systems interact, to maintain and perpetuate life. This knowledge has its roots in medicine, nutrition, agriculture, fermentation and natural products chemistry. It also aims to provide an understanding of the principles and application of primary and secondary metabolites.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn carbohydrate metabolism in detail by analyzing all the pathways.
- Learn the various aspects of lipid metabolism and their regulation.
- Understand the metabolism of Nitrogen and excretion of urea from body.
- Learn Nucleotide metabolism and clinical disorders of purine metabolism.
- Develop advanced knowledge of action of major hormones and principles and application of primary and secondary metabolites.

Course Contents:

Module I

Basics of structures of biopolymers; Carbohydrates, Lipids, Proteins and Nucleic Acids.

Module II

Carbohydrates Metabolsm – I

Anaerobic processes in generating metabolic energy

Glycolysis, fates of pyruvate: Lactate and ethanol metabolism, regulation of glycolysis, glycogen mobilization, regulation of glycogen breakdown.

Oxidative processes: Pyruvate oxidation, coenzymes involved in pyruvate oxidation and citric acid cycle, action of PDH, Complex, Krebs Cycle, Regulation of PDH and Krebs Cycle, anaplerotic sequences, glyoxylate cycle, PPP, Human genetic disorder involving PPP enzymes.

ETC and OP: Electron carriers in respiratory chain, OP, enzyme system for ATP synthesis, chemiosmotic coupling.

Carbohydrate Metabolism – II

Gluconeogenesis. Ethanol consumption and gluconeogenesis, reciprocal regulation of glycolysis and gluconeogenesis, glycogen metabolism in humans, photosynthesis.

Module III: Lipid Metabolism

Utilization and transport of fat and cholesterol, lipoproteins, fatty acid oxidation, oxidation of unsaturated and odd numbered C chain, control of fatty acid oxidation, biosynthesis of fatty acids, fatty acid desaturation, control of fatty acid synthesis, variants of fatty acids synthesis that lead to antibiotics (polyketides), biosynthesis of TAG, biosynthesis of cholesterol.

Module IV: Nitrogen Metabolism

Utilization of ammonia – GDH, GS, transamination, Biosynthetic of amino acids, amino acids degradation, detoxification and excretion of ammonia, urea cycle, transport of ammonia to liver, porphyrin and hememetabolism – The succinate-glycine pathway, Biological Nitrogen fixation.

Module V: Nucleotide Metabolism

De novo and salvage pathway for synthesis of pyrimidine and purine nucleotides, purine degradation and clinical disorders of purine metabolism (Gout, lesch – nyhan syndrome, immuno deficiency), pyrimidine breakdown, reduction of ribonucleotides to deoxyibonucleotides, thymidylate synthetase – a target enzyme for chemotheraphy.

Module VI: Integration of cellular metabolism and hormonal regulation

Action of major hormones (insulin, glucagon, epinephrine) responses to metabolic stresses: starvation.

Module VII: Secondary Plant Metabolism

Importance of secondary metabolites, terpenes, classification, mevalonic acid pathway, phenolic compounds, shikimic acid pathway, alkaloids.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing

References:

- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange.
- Biochemistry (Fifth Edition), LubertStryer

ADVANCED MICROBIAL TECHNOLOGY

Course Code: BMB 702 **Credit Units: 03**

Course Objective:

To acquaint the students about the microbiology and role of various microorganisms in different biotechnological applications, various techniques for their cultivation and control.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Recognize and explain the significant role that microbes play in the world around us.
- Explain the similarities and differences of microbes as compared to higher forms of life.
- Identify microbes and explain methods of growth and cultivation as well as structural and biochemical differences.
- Understand the microbial structure, function, metabolism, growth, genetics, and control - including antibiotic usage.
- Explain the basic principles of immunology relating to host resistance.
- Evaluate the physical and chemical methods of microbial control.
- Recognize microbial diseases and their control.

Course Contents:

Module I:Introduction to microbiology

Bacteria – Morphology and classification. Abnormal forms of bacteria, archaebacteria, mycoplasma and PPLO, cultivation of bacteria – nutritional requirements of micro organism, physical requirements, different types of media & their preparations. Isolation of pure cultures, maintainance and preservation of the pure cultures. Culture characteristics – Bacterial growth – Growth curve, batch and continuous cultures di auxic and synchronous growth Eneumeration of cells by direct and indirect methods,

Module II: Control of micro-organisms

Concept of sterilization and disinfection. Physical and chemical methods of control.Chemotherapeutics – mode of action of antibiotics, Penicillin, ampicillin, sulfonamide, vancomycin, streptomycine, tetracycline, chloramphenicol, antifungals, antiviral etc.

Module III: Microbial genetics

Molecular classification of microbes, The Basics of microbial genetics, prokaryotic gene organization, The basic principles of microbial DNA, replication, transcription and translation.Microbial regulation of gene expression: the *trp* and *lac* operon. Gene Transfer Genetic change: transformation, transduction, conjugation, plasmids, transposons. Viral Genetics Reproductive cycles of bacteriophage, T4 and lambda.

Module IV: Medical microbiology

Normal microflora of host, host parasite interactions, mechanisms of pathogenesis, and clinical manifestations associated with medically-important pathogenic microorganisms (bacteria, fungi, parasites, and viruses), applications of the basic principles of microbiology in effective diagnosis, treatment and prevention of infectious disease

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
- General Microbiology, R.Y. Stanier, J.L. Ingraham, M. L. Wheelis and P.R. Painter, Macmillian

References:

- Principles of Microbiology, R.M. Atlas, Wm C. Brown Publisher.
- The microbes – An Introduction to their Nature and Importance, P.V. Vandenmark and B.L. Batzing Benjamin Cummings.
- The Microbial World, Roger Y. Stanier, Prentice Hall
- Microbiology, Tortora, Funke and Chase, Benzamin& Cummings.

BIOPHYSICS AND BIOANALYTICAL TECHNIQUES

Course Code: BMB 703 **Credit Units: 03**

Course Objective:

Biophysics aims at investigating the structure and operations of living systems with the aim of the concepts theory and methodology of both experimental and theoretical physics, which is utmost, required for connecting the fundamental principles and their applications with life sciences. The students will be exposed to different instruments in order to develop competency and expertise in experimental techniques methodology and safe laboratory practice.

Learning Outcomes

After successful completion of the course student will be able to:

- Know about membrane biophysics, nerve impulse conduction and measurement of membrane potential.
- Learn about the radiation biophysics and its uses such as tracer techniques etc.
- Learn about various spectroscopic techniques and X –ray crystallography.
- Learn the various electrophoresis techniques for the separation of DNA/RNA/Protein.
- Learn different chromatography and centrifugation techniques for separation of bio-molecules.

Course Contents:

Module I: Membrane Biophysics
Genesis of membrane potential in nerve & membrane, Nerst& Goldman equation, Patch Clamp and Voltage –Clamp techniques for measuring membrane potential.

Module II: Radiation Biophysics
Tracer Technology, Dose response relationship, Radioisotopes in Diagnostics and Biotechnology, Geiger-Mueller Counter, Scintillation Counters.

Module III: Non-Radioactive tracer Technology
Metabolic and physiological tracer techniques, non-radioactive labels, labeling and detection methods using fluorescent molecules.

Module IV: Spectroscopy and X –ray crystallography
UV-Vis spectrophotometry, Mass spectrometry, MALDI and ESI, NMR, ESR, X-Ray Crystallography.

Module V: Electrophoresis
Paper and gel electrophoresis, Immuno-electrophoresis, Isoelectric Focusing, Capillary electrophoresis.

Module VI: Chromatography and Cetrifugation
Thin layer, Affinity, gel permeation, ion exchange chromatography, GLC, HPLC, Ultracentrifugation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- **Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker.**

References:

- **Bioinstrumentation, Webster.**
- **Principles of Fermentation Technology, P.F. Stanbury, A. Whitaker & S.J. Hall.**
- Microscopic Techniques in Biotechnology, Michael Hoppert.
- Principles & Practice of Bioanalysis, Richard F. Venn.

ADVANCED CELL BIOLOGY AND GENETICS

Course Code: BMB 704 **Credit Units: 04**

Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. They incorporate elements of biology, maths, physics and chemistry with combination of computers and electronics. The objective of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of these recent techniques. Students are also exposed to phenomenon that regulates cell death and etiology of cancerous cells.

Learning Outcomes:

After successful completion of the course student will be able to:

* Analyse hereditary data and apply fundamental knowledge in genetic calculations and chromosomal aberrations.
* Understand various cellular organelles, its structure, function, phenomenon of protein sorting and targeting and also the transport across these organelles.
* Understand molecular mechanisms of how and why cells move?
* Understand the molecular structure and function of various receptors and mechanism of cell signalling.
* Understand different molecular mechanisms that bring about cell death or factors that lead to cancer.

Course Contents:

Module I

Mendilian principles on inheritance; Chromosome theory of inheritance, linkage and chromosome mapping, interference and coincidence, cytological basis of crossing over.
Extrachromosomal inheritance:,Mitocondrial and chloroplast genetic code
Chromosomal aberration and polyploidy
Concept of gene – classical and modern, psendoallelism, position effect, intragenic crossing over & complementation (cistron, recon &nutron) Benzer's work on r II locus in T_2 bacteriophage.
Population genetics- Hardy weinbergsselection , k and r selection

Module II: Cell Organelles

Structure of nuclear envelope, nuclear pore, complex, transport across envelope; regulation of nuclear import
Targeting proteins to endoplasmic reticulum, signal recognition and receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein, photorespiration; cell-cell interaction.

Module III

Structure and organization of actins filaments; Actins, myosin muscle contraction, Microtubule-structure and assembly, cilia, flagella-structure.

Module IV

Modes of cell signaling, steroid hormone receptors, peptide hormones and growth factor, plant hormones, G-protein coupled receptors; receptor – protein tyrosine kinase,Phosphotidylinositol signal transduction pathay, primary signals, secondary signals, c- AMP pathway of signal transduction; c GMP, phospholipids and calcium ions, Ras, Raf, MAP kinase pathway, JAK –STAT pathway, Integrin signaling, Hedgehog and Wnt pathways, Apoptosis – role of caspases.

Module V: Cancer biology

Types of cancer; development of cancer**,** cells; Oncogenes, protooncogenes, function of oncogene products, tumor suppressor genes, function of tumor suppression gene products, role of oncogene and tumor suppressor gene in development, molecular diagnosis of cancer.

Module VI: Cell Cycle

Phases of eukaryotic cell cycle; Cell cycle regulation, checkpoints in cell cycle; regulators of cell cycle inhibitors of cell cycle, stem cells – properties and medical application.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Essential Cell Biology : An Introduction to the Molecular Biology of the Cell, B. Alberts, D. Bray, A. Johnson, J. Lewis, M. Roff, K. Robert, P. Walter and K. Roberts, Garland Publishing Company
- Cell and Molecular Biology, DeRobertis, B .I. Publication Pvt. Ltd
- Principles of Genetics, E J Gardner, John Wiley & Sons Inc.

References:

- Cell in Development and Inheritance, E.B. Wilson, Macmillan
- Developmental Biology, S.F. Gilbert, Sinauer Associates Inc.
- Molecular Cell Biology, H. Lodish, A.Berk, S.L. Zipursky, P. Matsudaura, D. Baltimore and J. Danell, W.H. Preeman and Company.
- Cell and Molecular Biology, Gerald Karp, John Wiley and Sons Inc.
- Principles of Genetics, D.P. Snustad& M.J. Simmons, John Wiley and Sons Inc.

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: BMB 705 **Credit Units: 03**

Course Objective:

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

Learning Outcomes:

Upon course completion, students will be able to understand:

- Fundamental knowledge of basic statistical Techniques.
- Various Statistical Tools used in data presentation and interpretation
- Probability and various distributions.
- Formulation and testing of hypothesis
- Correlation & Regression analysis.
- Analysis of variance(ANOVA)
- Applications of various statistical methods using statistical softwares like SPSS, SAS etc.

II.

III. Course Contents:

IV. Module I:Descriptive statistics

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

Module II

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

Module III:Inferential statistics

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module IV

Applications of statistical methods using statistical software

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

References:

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S.Chand& Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

COMPUTER APPLICATIONS

Course Code: CSE 703 | **Credit Units: 03**
Total hours: 30

Course Objective:

The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Contents:

Module I: Introduction to computers (6 Hours)
Computer fundamentals: History and development of computers, Computer architecture. History and development of software: (generations of software), Types of software, Next generation of software, System Software (Operating Systems, Computer Languages, Application software).

Module II: Ms-Office (5 Hours)
Microsoft Excel- Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting, Validation, Subtotal, Importing data.
Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module III: Database Management system (7 Hours)
Introduction to DBMS, Traditional file system, Benefits of DBMS over traditional file system, Types of DBMS: OODMBS, RDBMS, NDBMS, DDBMS, HDBMS. Examples of each, Advantages and disadvantages of each SQL AND MS ACCESS as tools for understanding of DBMS concepts. Query handling, Forms (Develop a small application in MS-ACCESS using databases and forms as front end.)

Module IV: E-commerce and M-commerce (5 Hours)
Introduction to E-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, G2B etc Concept of Internet Banking, Online Shopping. Security Threats and remedies. (Piracy, Hacking, Cracking, Pishing, Spamming Etc.)

Module V: Introduction to Programming using C Language (7 Hours)
Software development life cycle, Flow charts and algorithms - Fundamentals of 'C' Language - Typical structure of a C Program., Relational operators - Logical operators - Precedence of operators - IF and IF .. ELSE statements – Loopingconcepts in WHILE loop, DO ... WHILE, FOR loops – programming examples, **Functions, Array, Structure**

Course Outcomes:

The student will learn

- Work effectively with a range of current, standard, Office Productivity software applications.
- Evaluate, select and use office productivity software appropriate to a given situation.
- Apply basic adult learning and assessment principles in the design, development, and presentation of material produced by office productivity applications.
- Demonstrate employability skills and a commitment to professionalism.
- Operate a variety of advanced spreadsheet, operating system and word processing functions.
- A basic idea of computer programs and its database.

Examination Scheme:

Components	A	CT	S/V/Q/HA	ESE
Weightage (%)	5	15	10	70

A: Attendance, CT: Class Test,:, S/V/Q/HA: Seminar/Viva/Quiz/Home Assignment, ESE: End Semester Examination;

Text & References:

- Introduction to Computers, Sinha & Sinha
- Elmasri, Et al, Fundamentals of Database Systems, 1st Ed, Pearson Education Inc.
- Programming In C, E Bala Guru Swamy , Microsoft office 2003 – Complete reference
- Kamlesh Bajaj &Debjani Nag, E-commerce the Cutting Edge of Business, 2nd Ed, TMGH

BIOCHEMISTRY LAB

Course Code: BMB 720 **Credit Units: 02**

Course Contents:

Module I: Proteins

Identification of protein by Biuret test.

Quantization of protein by Bradford method

Separation of proteins by SDS-PAGE

Module II: Enzyme

Enzyme activity study of serum alkaline phosphates.

Module III: Nucleic Acid

Biochemical estimation of DNA

Biochemical estimation of RNA

Separation of DNA on Arose gel.

Module IV: Carbohydrate

Biochemical estimation of blood sugar

Module V: Lipids

Blood Cholesterol estimation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ADVANCED MICROBIAL TECHNOLOGY LAB

Course Code: BMB 721 **Credit Units: 01**

Course Contents:

Module I

Aseptic techniques: preparation of culture media for cultivation of specific microorganism.

Staining techniques - simple staining. acid fast and endospore staining, differential Gram staining, lactophenol cotton blue staining for fungi

Module II

Biochemical test - Indole test. methyl red test. vogesproskaeur lest. citrate utilization. starch hydroysis, protease. catalase test and oxidase test.

Module III

Isolation of special microbes from environment by isolation and enrichment techniques

Water microbiology- standard plate count, presumptive and confirmed colilform test. BOD and COD Soil microbiology: Isolation of rhizosphere microflora (actinomycetes, azotobacter, bacteria and fungi)

Module IV

Antibiotic sensitivity test by disc diffusion assay

Module V

Biochemical and molecular characterization of micro organisms

Determination of growth curve of bacteria and fungi and determination of substrate degradation profile Determination of KLa.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CELL BIOLOGY AND GENETICS LAB

Course Code: BMB 722 **Credit Units: 01**

Course Contents:

Module I

Cell fractionation and separation of cell organelles by ultra centrifugation.

Module II

Isolation of chloroplast from spinach and study of electron transport chain.

Module III

Isolation of mitochondria and study of electron transport chain.

Module IV

Study of apoptosis by TUNEL method.

Site directed mutagenesis

Mutation detection and analysis

Mitosis

Meiosis

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMPUTER APPLICATIONS LAB

Course Code: CSE 723 **Credit Units: 01**

Total hours: 20

Course Contents:

Module I: Ms-Office (8 Hours)

Excel: Implementation of Simple formula, different function like Sum, max, min, sumif, countif, if, vlookup, hlookup, filter, pivot table, goal seek, charts, macro, formula auditing, conditional formatting,Validation, Subtotal, Importing data.

Preparation of effective documents with Ms – word, Preparation of effective presentation with Ms-PowerPoint.

Module II: MS – Access 2003 (4 Hours)

Database Creation, Creation of tables, Query creation – Insert query, Update Query, Delete query , Append query, Cross Tab Query . A simple form creation for data entry based on tables and query.

SQL – DDL, DML DCL, implementation of sub Query

Module III: Introduction to Programming using C Language (8 Hours)

Implementation of different c Programs using if, switch case, loops, Array, functions and structure.

Course Outcomes:

The student will learn

- To operate MS word and its operations and functions
- To know the concepts of DBMS and its query execution.
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs

Examination Scheme:

IA			EE			
A	**PR**	**Practical Based Test**	**Major Experiment**	**Minor Experiment**	**LR**	**Viva**
5	10	15	35	15	10	10

- Note: IA –InternalAssessment, EE- External Exam, A- Attendance PR- Performance, LR – Lab Record, V – Viva.

ADVANCED COMMUNICATION-VII

Course Code: BCP 741 **Credit Units: 1**

Course Objective:
The Course is designed to enhance vocabulary skills and make students fluent, thereby improving receptive and expressive skills.
Prerequisites: NIL.
Course Contents / Syllabus:

Module I Fundamentals of Communication.	**30% Weightage**
• Role and Purpose of Communication,7 C's of Communication • Barriers to Effective Communication • Forms of Communication: One-to-One, Informal and Formal	
Module II Oral Communication	**20% Weightage**
• Effective Listening: Principles and Barriers • Effective Speaking: Pronunciation and Accent	
Module III Building Advanced Vocabulary	**20% Weightage**
• Word Formation; Synonyms; Antonyms; Eponyms; Homonyms, Homophones & Homographs • One Word Substitution; Phrasal Verbs, Idiomatic Expressions & Proverbs • Foreign Words in English	
Module IV Non Verbal Communication	**30% Weightage**
• Principles & Significance • Kinesics, Oculesics, Proxemics,, Para-Language, Artifacts, Chronemics, Tactilics	
Student Learning Outcomes	
The students will be able to use the LSRW Skills to communicate effectively in a professional environment.Will be able to develop fluency.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

End Term Examination				
Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:
Jones, Working in English, 1st ed. Cambridge, CUP 2001
Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Butterfield, Jeff Soft skills for Everyone, Cengage Learning 2011
Reference: *Guffey, Ellen Mary, Business Communication, Thomson (South Western)*
Dale Carnegie: Quick and Easy Way of Public Speaking
Business Communication Today – Courtland L Bovee, John V Thill Mukesh Chaturvedi, Pearson 2009.
Additional Reading: Newspapers and Journals.

Behavioral Science -VII

Course Code: BSP-743 **Course Credit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

elf and the process of self exploration

- Learning strategies for development of a healthy self esteem
- Importance of attitudes and their effect on work behavior.
- Effective management of emotions and building interpersonal competence.

Course Contents:

Module I: Understanding Self **(2 Hours)**

- Formation of self concept
- Dimension of Self
- Components of self
- Self Competency

Module II: Self-Esteem: Sense of Worth **(2 Hours)**

- Meaning and Nature of Self Esteem
- Characteristics of High and Low Self Esteem
- Importance & need of Self Esteem
- Self Esteem at work
- Steps to enhance Self Esteem

Module III: Emotional Intelligence: Brain Power **(2 Hours)**

- Introduction to EI
- Difference between IQ, EQ and SQ
- Relevance of EI at workplace
- Self assessment, analysis and action plan

Module IV: Managing Emotions and Building Interpersonal Competence **(2 Hours)**

- Need and importance of Emotions
- Healthy and Unhealthy expression of emotions
- Anger: Conceptualization and Cycle
- Developing emotional and interpersonal competence
- Self assessment, analysis and action Plan.

Module V: Leading Through Positive Attitude **(2 Hours)**

- Understanding Attitudes
- Formation of Attitudes
- Types of Attitudes
- Effects of Attitude on
  1. Behavior
  2. Perception
  3. Motivation
  4. Stress
  5. Adjustment
  6. Time Management
  7. Effective Performance

  Building Positive Attitude.

Student learning outcomes:

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course. Suggested Readings:

- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.,
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt.Ltd.,
- Dr. Dinkmeyer Don, Dr. Losocy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

Français-VII

CourseCode:FLP744 **CreditUnits:02**

Course Objective:

Tofamiliarizethe studentswiththe Frenchlanguage

- withthe phonetic system
- withtheaccents
- withthemanners
- withthe cultural aspects

Toenablethe students

- toestablishfirstcontacts
- toidentifythingsandtalkaboutthings

CourseContents:

Unité 1,2: pp.01to37

Introductionàlalangue:système phonétique, accents, genre etaccord,jours,mois,nombres

Actesde communication:

Unité 1:Premierscontacts

1. nommerdesobjets,s'adresserpoliment à quelqu'un
2. se présenter, présenterquelqu'un
3. entrerencontact: dire tuouvous,épeler
4. dire oùontravaille,ce qu'onfait
5. communiquersescoordonnées

Unité 2:Objets

1. identifierdesobjets,expliquerleurusage
2. dire ce qu'onpossède,faireunachat,discuterle prix.
3. monteretsituerdesobjets
4. décrire desobjets
5. comparerdesobjets,expliquersespréférences

Grammaire:1.articlesindéfinis,masculinet féminindesnoms,pluriel desnoms
2.Je,il,ellesujets,verbesparler,habiter,s'appeler,être,avoir,masculinet féminindesadjectifsde nationalité
3.tu,voussujets,verbesparler,aller,être,c'estmoi/c'esttoi
4.verbesfaire,connaître,vendre,c'est/il est +profession,quiest-ce ?qu'est- ce que...?
5.article défini,complément dunom avec de,quel interrogatif
6.adjectifspossessifs(1),pour+ infinitif
7. verbe avoir,ne...pas/pasde,questionavec est-ce que ?,questionnégative, réponse Si
8. Prépositionsdelieu, ilya/qu'est-ce qu'il ya
9 .accordet place desadjectifsqualificatifs,il manque...
10.comparatifsetsuperlatifs, pronomstoniques,pronomon

ExaminationScheme

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weight age (%)	15	10	5	**30**	**70**	

Text &References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

ADVANCEDMOLECULAR BIOLOGY

Course Code: BMB 801 **Credit Units: 04**

Course Objective:

The objective of the course is to provide a clear understanding of DNA (genetic material) so that they can manipulate it and understand basic tools and techniques involved in its manipulation. Strong foundation in molecular biology enables the students to familiarize themselves with Genetic engineering technology.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Learn and develop advanced understanding of mechanism of DNA replication in prokaryotes and eukaryotes.
- Learn the advanced mechanism of transcription in prokaryotes and eukaryotes.
- Develop understanding of various post-transcriptional processes in cell.
- Learn in detail about the mechanism of protein synthesis in prokaryotes and eukaryotes.
- Understand about the advances of gene expression regulation and various mechanisms of gene silencing.

Course Contents:

Module I: DNA replication and repair

DNA polymerases in prokaryotes and eukaryotes; replication protein, replication fork; termination of replication DNA repair, photo reaction, base excision repair, nucleotide excision repair, transcription coupled repair, mismatch repair , error pone repair recombinational repair.

Module II: Transcription of DNA

Transcription in prokaryotes and eukaryotes, RNA polymerase – Composition and function; transcription mechanism; transcription factor and their role, inhibition of RNA synthesis.

Module III: Processing of RNA

Procession of ribosomal and transfer RNA"s processing of mRNA-5'cap formation; 3' polyadenylation ; RNA splicing , RNA editing , RNA degradation.

Module IV: Translation

Translation mechanism in prokaryotes and eukaryotes; ribosomes, initiation of translation, elongation, termination, amino acid activation; translational recoding inhibitors, post translation modification of protein.

Module V: Regulation of gene expression

Regulation in prokaryotes – repressors and negative control, positive control, role of c AMP, Ampreceptor protein, lac, tryp, His and ara operons, Regulation in Eukaryotes=promoters and enhancers, transcriptional regulatory protein, transcriptional activators, eukaryotic repressor.

Module VI: Gene Silencing

RNAi (SiRNA and MiRNA) molecular mechanism and current application in gene silencing, Antisense RNA technology, Biochemistry of ribozyme

Hammer head, hairpin ribozymes. Application of antisense and ribozymes in genetic engineering.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Concepts of Genetics, W.S. Klug, and M.R. Cummings 2004, Pearson Education

References:

- Genome, T.A. Brown, John Willey & Sons Inc.
- Molecular Biology of the Cell by Alberts Bruce, Bray Demos, and Watson James D.
- Gene VIII, Benjamin Lewin 2005, Oxford University Press
- Molecular Cell Biology, H. Lodish, A. Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.
- Molecular Cloning: A Laboratory Manual (3-Vilcume set), J. Sambrook, E.F. Fritsch and T. Maniatis, Cold spring Harbor Laboratory Press.
- Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison-Wesley Publishing.
- Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

ADVANCES IN GENETIC ENGINEERING

Course Code: BMB 802 **Credit Units: 04**

Course Objective:

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR, etc. for the cloning and expression of genes can be obtained by undertaking the present course. The implication and successful application of biotechnology largely depend on these advanced molecular techniques. Thus, the objective of this course is to familiarize the students with all practical tools and techniques required for creating a recombinant DNA molecule and transforming the appropriate host cell to check the expression of recombinant DNA. The aim of this course is also to enlighten the students with the recent advancement in stem cell research.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Know the description of different types of cloning vectors.
- Understand the cDNA and genomic DNA library preparation.
- Understand the identification of gene and a complete genome done by conventional and next generation sequencing.
- Understand the characterization of genes and genomes.
- Know the different types of dominant and co-dominant molecular markers
- Understand the applications of genetic engineering in agriculture, industries and allied sectors.

Course Contents:

Module I

Vectors for cloning- plasmids, phagemids, Cosmids, bacteriophages, BAC, PAC, YAC vectors for eukaryotes.Bacullo virus based vectors. Special purpose vectors : Expresion vector to make single stranded DNA for sequencing, Vector for preparing RNA probe, vector for maximizing protein synthesis

Module II

Obtaining foreign gene of interest, use of restriction endo nucleases, restriction modification systems, difference between type I, II and III restriction in endo nucleases and restriction mapping, construction of cDNA, chemical synthesis of DNA. DNA modifying enzymes and their applications. Gene libraries: Genomic DNA and cDNA libraries. Blotting techniques and probe construction

Module III

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method Molecular markers and their types, RAPD, RFLP, ISSR, SSR, Microsatellite and minisatellite, PCR and its different variants.

Module IV

Application of genetic engineering in medicine, forensic science, agriculture and production of recombinant proteins.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Developmental Biology, 6th Edition, Scott F. Gilbert
- Recombinant DNA, J.D. Watson et al, W.H. Freeman and Company
- Principles of Gene Manipulation: An Introduction to Genetic Engineering, R.W. Old and S. B Primrose, Blackwell Science Inc
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine, P.B Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- Milestones in Biotechnology: Classic Papers on Genetic Engineering, J.A. Bavies and W.S. Reznikoff, Butterworth Heinemann.
- Gene Expression Technology, D.V. Goeddel in Methods in Methods in Enzymology, Academic Press Inc.
- DNA Cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press.
- Molecular Cloning: A Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press.

BIOPROCESS TECHNOLOGY

Course Code: BMB 803 **Credit Units: 04**

Course Objective:

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important produ.

Learning Outcomes:

By the end of the course the student will be able to:

- Develop an understanding of the various aspects of bioprocess technology and their basic principles.
- Develop skills associated with controlling of various parameters of bioprocess monitoring.
- Understand principles underlying design of fermentor, fermentation Process and downstream processing.
- Get knowledge of industrial productions of various primary and secondary metabolites.

Course Contents:

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of air, fibrous filters, etc.

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium.
Biological heat transfer, Heat transfer coefficients.
Bioprocess control and monitoring variables such as temperature, agitation, pressure p4. On line measurement. On/off control. PID control computers in bio process control systems and down stream processing.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. power alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

ADVANCED GENOMICS AND PROTEOMICS

Course Code: BMB 804 **Credit Units: 04**

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and bioinformatics, it is desirable to have in depth study on these lines.

Learning Outcomes

After successful completion of the course student will be able to:

- Develop knowledge of fundamental techniques in proteomics.
- Learn various modules of MALDI TOF for analysis of proteins.
- Understand Genome anatomy, gene expression and Post translational modification.
- Understand the occurrence of disease due to misfolding of proteins.
- Get detail knowledge and understanding of Protein – protein interaction.

Course Contents:

PART I: GENOMICS

Module I

Introduction to Genomics: The human genome project "Anatomy of prokaryotic and eucaryotic genome: repetitive DNA and RNA Contents of genoms.

Module II

Transcriptomics and metatranscriptomics: Introduction , method and uses.genetic mapping

Module III

Microsatellite DNA markers, RFLP, DNA sequencing, polyogemy,

Module IV

Micro array: DNA micro array marker, computational methods.

PART-II: PROTEOMICS

Module V

Introduction to proteomics

Fundamental methods used in proteomics. 2-D gel electrophoresis + mass spectroscopy.

Module VI

Post translationalprotein modification

Module VII

Protein – protein interaction someexamples

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Genes & Genomes, Maxine Singer and Paul Berg
- Genomes II, T.A. Brown

***References*:**

- A Primer of Genome Science, Greg Gibson and Spencer V. Muse
- Database Annotation in Molecular Biology: Principles and Practice, Arthur M. Lesk
- DNA: Structure and Function, Richard R. Sinden
- Recombinant DNA (Second Edition), James D. Watson and Mark Zoller
- Gene Cloning and DNA Analysis – An introduction (Fourth Edition), T.A. Brown
- www.panimatext.com

COMPUTATIONAL BIOLOGY

Course Code: BMB 805 **Credit Units: 03**

Course Objective:

The objective is to describe how molecular data can be used to construct a phylogenetic tree and characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms, which underlie evolution at the molecular level.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Understand and explain the development of computational biology.
- Describe the fundamentals of bioinformatics databases and their application.
- Understand and explain the use of various computational methods for phylogentic studies
- Use and apply the knowledge of different softwares and programs for sequence comparison, molecular modeling
- Explain the applications of computational biology in different fields of sciences.

Course Contents:

Module I: Introduction to Computational Biology. History of Bioinformatics

Module II: Bioinformatics Fundamentals

1. Major information Resources & Databases in Bioinformatics
   a. Information Resources: NCBI, EBI, ExPasy Entrez & SRS System
   b. Primary Sequence & Structure Databases: Genbank, SwissProt/Uniprot, EMBL, PIR, PDB, MMDB, NDB, CSD, KEGG etc.
   c. Derived (Secondry) Databases of Sequences and structure:
      i. Prosite, PRODOM, PRINTS, Pfam, BLOCK, INTERPRO etc.
      ii. SCOP, CATH, DSSP, FSSP, RNAbase,
   d. Genome Databases (at NCBI, EBI, TIGR, SANGER), High-throughput genomics sequence (EST, STS, GSS), ENSEMBL.
2. Sequence File formats: fasta, genbank, embl, Swiss-prot, pdb, nbrf, pir and multiple sequences formats (Aln, Mega, Pileup, phylip etc.)
3. Sequence Similarty Basics: Similarty, Indentity, Homology, Scoring, selectivity/Sensitivity, Gap cost, Linear and Affine Gap Penalty, Basic of scoring system and matrices (PAM, BIOSUM, GONNET etc.)
4. Pairwise Sequences Aligment: Brute Force method, Dot matrix method, Global (Needleman-Wunsch) and Local Alignment (Smith-Waterman) using Dynamic programming.
5. Scoring Matrices: Substitution Matrices, Concept log-odds, PAM & BLOSUM Series, Derivation of PAM & BLOSUM matrices, Distance and Similarity matrices.
6. Similarity Searching Tools: BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI-BLAST and PHI BLAST, Statistical Significance.
7. Sequence Pattern and Profiles: Concepts of motif, pattern and profile, Profile construction and its application in Bioinformatics,

Module III: Computational Methods

Scoring methods of MSA (sum of pair, Multidimensional DP, Progressive, Iterative, Probabilistic)
Phylogenetics prediction mrthods: Basics, molecular clock, Substitution Models of evolution, Tree reconstruction methods (Distance based, character based method, statistical), Bootsstrapping.
Suffix tree and its applications in Bioinformatics
Gene Indentification Methods
Predictive Methods using DNA and Protein sequences.
Statistical Modeling: Log-likelihood, Bayesian network, Markov and hidden markov models.
Clustering Algorithms: K-means, Hierarchical and Mixture of Gaussion.

Module IV: Application and software tools

Software and Programmes for sequence comparision and analysis.
Phylogenetics analysis software.
Molecular Structure drawing tool.
Molecular modeling/Docking.
Application of computational biology/Bioinformatics in Agriculture, Human health, Enviroment, Biotechnology, Molecular Biology, Neurobiology, Drug Designing, Veterinary Science.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- **Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.**

***References*:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
- Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
- Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
- Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
- Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: BMB 806 **Credit Units: 03**

Course Objective:

To introduce the students to regenerate clean environment using biotechnology as the key tool and provide them the insight for eco-friendly approach along with the concept of sustainable development.

Course Contents:

Module I

Environmental pollution and its major impacts on human beings, plants, animals and climate, concept of Global warming and climate change, Global Ozone Problem, Eutrophication, Land degradation, Biomagnification.

Module II

Non-renewable and renewable energy resources, concept of clean fuel technology, Biomass energy and biofuels

Module III

Biodegradation, Bioremediation and Phytoremediation of major pollutants (PAH, Pesticides etc), Use of microbial technology for mining of metals (Bioleaching) and Concept of Biomineralisation.

Module IV

Waste water engineering: physicochemical characteristic of water, waste water treatment of municipal wastes and industrial effluents with special focus on use of biological methods, Advanced waste water treatments

Module V

Bioassessment of environmental quality: Biosensors and biomarkers, Principles of ecotoxicity.
Agriculture Sustainability and Clean agricultural practices: Biofertilizers, Biopesticides and vermi composting

Module VI

Environmental impact assessment and Environmental audit, Related case studies from India.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Environmental Science, S.C. Santra
- Environmental Biotechnology, Pradipta Kumar Mohapatra

References:

- Environmental Biotechnology – Concepts and Applications" by Hans-Joachim Jordening and Jesef Winter
- Waste Water Engineering by Metcalf and Eddy. Publisher: Tata McGraw hill
- Environmental Microbiology: Methods and Protocols by Alicia L. Ragout De Spencer, John F.T. Spencer
- Introduction to Environmental Biotechnology by Milton Wainwright
- Principles of Environmental Engineering by Gilbert Masters

ADVANCED MOLECULAR BIOLOGY LAB

Course Code: BMB 820 **Credit Units: 02**

Course Contents:

1. Isolation of genomic DNA from prokaryotic and Eukaryotes.
2. Isolation of plasmid.
3. Study of DNA protein interaction.
4. Study of in vitro transcription.
5. Study of DNA methylation.
6. Study of DNA repair mechanism.
7. Invitro study of translation
8. Isolation of RNA
9. PCR and Gradient PCR

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETIC ENGINEERING LAB

Course Code: BMB 821 **Credit Units: 02**

Course Contents:

1. Study of gene expression in E.coli.(GFP cloning).
2. Study of Southern Hybridization.
3. Study of RFLP/RAPD.
4. Study of Western blotting.
5. Study of restriction digestion.
6. Study of legation.
7. PCR amplification.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

BIOPROCESS TECHNOLOGY LAB

Course Code: BMB 822 **Credit Units: 02**

Course Objective:

The present course aims to acquaint the students with lab-scale cultivation of microbes for production of industrially important products with the concept of scale up processes and to extract different bioproducts during their characterization.

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.

Module II

Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module III

Comparative studied of ethanol production using different substrates, Production and estimation of alkaline protease, Microbial production of antibiotics (Penicillin)

Module IV

Conventional filtration and membrane based filtration, Aqueous two-phase separation, Ion exchange chromatography, Gel Permeation chromatography

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

ADVANCED GENOMICS AND PROTEOMICS LAB

Course Code: BMB 823 **Credit Units: 01**

Course Objective:

The course will serve to introduce students to the materials and methods of DNA and protein analysis and the computational tools developed for genomics and proteomics in a variety of species

Course Contents:

Module I

Three dimensional Structures – *In silico* study – large molecular complexes RNA polymerase II, ribosome, unstructured proteins, Genomic DNA extraction from microbial or plant system and agarose gel electrophoresis.

Module II

PCR of structural or functional genes, RFLP, clustering, DNA sequencing methods, gene finding tools and Genome annotation

Module III

Comparison of two given genomes, Native/SDS-PAGE analysis of protein extracted from plant or microbial system., Analysis of 2D – IEF datausing PDquest software

Module IV

Primer designing, Analysis of protein 3D structures and comparison,.Micro array and Micro array data analysis, Inference of protein function from structure

Module V

Two-hybrid methods

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Note: Minor variation could be there depending on the examiner.

COMPUTATIONAL BIOLOGY LAB

Course Code: BMB 824 **Credit Units: 01**

Course Contents:

Module I

Basics of sequence analysis retrieving a sequence –nucleic acid /protein

Module II

Local and global alignment – concepts pair wise sequence alignment, multiple sequence alignment, dynamic programming – Smith Watermann algorithm, Needleman Wunsch Algorithm

Module III

Motif and pattern searching, structure prediction, protein structure classification resources, structure superposition tools, energy minimization and simulated annealing

Module IV

Phylogenrtic prediction and analysis

Module V

Docking small molecules/ peptides in active site of protein. Use of automated docking procedures . Free energy calculation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Advanced Communication-VIII

Course Code: BCP 841 **Credit Units: 1**

Course Objective:

The course is designed to make the students ready for placement.

Prerequisites: NIL

Module I Job Correspondence	**20% Weightage**
• Job Applications • Resume & Profile Writing for Social Media • Follow Up Letter	
Module II Dynamics of Group Discussion	**30% Weightage**
• Methodology • Guidelines	
Module III Speaking for Employment	**50% Weightage**
• Types of Interview (Technical & HR Rounds) • Fundamentals of Facing Interviews • Question Answer on Various Dimensions • Non-Verbal Communication Component • Interview Etiquettes	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures **Student Learning Outcomes:** The student will be able to write an impressive resume and face the interview confidently.	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100`%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Bovee, L Courtland, Mukesh chaturvedi, and John U Thill, Business Communication Today, Pearson

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006

Comfort, Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)

Stay Hungry, Stay Foolish: Rashmi Bansal

Business Maharajas: Gita Piramal

How to Make Friends in Digital Age: Dale Carnegie

Business Communication / Making Connections in a Digital World, Raymond V. Lesikar, Marie E Flattey, Kathryn Rentz, Neerja Pande, Mc Graw Hill, 2009

Additional Reading: Newspapers and Journals.

BEHAVIORAL SCIENCE-VIII

Course Code: BSP-843 **Credit unit: 01**

Total Hours: 10

Course Objective:

This course aims at imparting an understanding of:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.
- Enhancing personal effectiveness and performance through effective interpersonal communication
- Enhancing their conflict management and negotiation skills.

Course Contents:

Module I: Conflict Management **(2 Hour)**

- Meaning and nature of conflicts
- Types of Conflict
- Styles and Techniques of conflict management
- Conflict management and interpersonal communication

Module II: Behavioral & Interpersonal Communication **(2 Hours)**

- Importance of Interpersonal Communication
- Rapport Building – NLP, Communication mode
- Steps to improve interpersonal communication
- Meaning and Nature of Behavioural Communication
- Relevance of Behavioural Communication

Module III: Relationship Management for Personal and professional Development **(2 Hours)**

- Importance of relationships
- Maintaining healthy relationships
- Communication Styles
- Types of Interpersonal Relationships

Module IV: Stress Management **(2 Hours)**

- Understanding of Stress & GAS Model
- Symptoms of Stress
- Individual and Organizational consequences with special focus on health
- Healthy and Unhealthy strategies for stress management
- Social support for stress management and well being
- Stress free, Successful and Happy Life

Module V: Conflict Resolution & Management **(2 Hours)**

- Conflict Resolution Strategies
- Ways of Managing Conflict (Healthy & Unhealthy)
- Impact of Conflict Resolution & Management

Student learning outcomes

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme.

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

The above evaluation scheme shall not be applicable for LLM Course.

Suggested Readings:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassel.
- Goddard, Ken: Informative Writing, 1995 1st Edition, Cassell
- Harvard Business School, Effective Communication: United States of America.
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

Français-VIII

CourseCode:FLP 844 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictoolstoenable the students
_ totalkabouttime schedules
_ totalkabouttravel
_ toperform simple communicative tasks(fixappointments,makereservations,discusshabits,giveadvice, directions)

CourseContents:
Unité 3, 4: pp. 42 to 72:
Actes de communication:

Unité 3 : Emploi du temps.

1. demanderet donnerl'heure,deshoraires
2. racontersa journée
3. parlerde seshabitudesautravail,de sesloisirs
4. dire la date,parlerdutempsqu'ilfait
5. fixerrendez-vous (autéléphone pare-mail),réserverunetable aurestaurant

Unité 4:Voyage

1. réserverune chambre d'hôtel,demanderla note
2. expliquerunitinéraire
3. parlerde sesdéplacements,situersurune carte
4. exprimerunconseil,uneinterdiction,une obligation
5. acheterunbilletdetrain,consulteruntableaud'horaires

Grammaire:

1.questionavec à quelleheure? adjectifsdémonstratifs
2. verbespronominauxauprésent,lesprépositionsà et de : alleràvenirde
3.adverbesde fréquence, pourquoi...? Parce que ...?
4. expressionindiquant la date, verbesimpersonnels
5. verbe pouvoir+ infinitif,lelundi,lundi prochain
6. adjectifspossessifs(2), adjectiftout
7. impératifprésent(1),nombresordinaux
8. questionsavec est-ce que ? àeten+ moyendetransport,en/au+pays
9.verbesdevoir+infinitif,il faut+ infinitif,ilest interdit de
10.verbes:aller,venir,partir,questionsavec d'où,où,paroù,à quel,de quel.

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

ADVANCED IMMUNOLOGY

Course Code: BMB 901 **Credit Units: 03**

Course Objective:

The aim to teach immunology and immuno technology to the students for their better understanding of immune system, types and mechanism of immunity, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of immune related diseases.

Learning Outcomes:

Having successfully completed this course, students will be able to:

- Know the cellular ontogeny and organ involvement in immunity, know the difference between innate and adaptive immunity, understand what antigens are and how they interact specifically with antibodies.
- Understand the molecular biology of antibodies synthesis, immune cells generation, structure of MHC molecules and their roles in immune response. Students will be able to understand the concept of transplantation and role of immunity in transplantation reactions.
- Understand the mechanisms of cell mediated immunity and hypersensitivity reactions. Students will be able to explain the concept of MHC restriction and role of complement system in immunity.
- Understand the mechanism and principle of self-tolerance and autoimmunity. Students will be able to know how the immune system can fight infections and cancer, including examples of immunotherapy to harness host immunity and role of immune system in fighting against infectious diseases. Describe the principles and applications of various techniques involved in studying antigen antibody interactions. Students will also be able to understand the concept of vaccines.

Course Contents:

Module I

Types of immunity - innate, aquired, passive and active physiology of immune response – MI and CMI specificity and memory. Antigen, antibody reactions. Antigens types Hapten, immunoglobuin structure, distribution and function

Module II

Molecular biology of Ig synthesis, Lymphoid tissues – ontogeny and physiology of immuno system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of mouse and man. Structure and function of class I and II molecules antigen distribution in population – HLA in human health and diseases. Transplantation immunity – organ transplantation and HLA tissue typing.

Module III

Cell mediated cytotoxicity. Hypersensitivity reactions, cellular interaction in immune response. Antigen recognition. T.B. cell receptors, MHC restriction, Lymphocyte activation clonal proliferation, differentiation. Interleukins and their roles. The complement systems mode of activation, classical and alternate pathway biological functions.

Module IV

Introduction to tumor immunology, autoimmune disorders and immunology of infectious diseases.
Antigen antibody reactions *in vitro* methods agglutination precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, ELISA, Radio immuno assays, *In vitro* methods, skin tests and immune complex tissue demonstrations. Applications of these methods in diagnosis of microbial infections, Vaccines

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Kuby Immunology, R.A. Goldsby, T.J. Kindt and B.A. Obsorne, Freeman
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company

References:

- Immunology (Sixth Edition), Roitt, Brostoff, Male, Panima Publication
- Fundamentals of Immunology, W. Paul, Lippincot Williams and Wilkins
- Immunology, W.L. Anderson, Frence Creek Publishing (Blackwell)
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.
- Immunology, Poitt, Mosby – Yearbook Inc.
- Perkin Elmer Antibody Manual
- Production of Monoclonal Antibodies – Detailed Protocol, G.K. Lewis, University of Maryland

ENZYME TECHNOLOGY

Course Code: BMB 902 **Credit Units: 03**

V.

Course Objective:

The course aims to provide an understanding of the principles and application of proteins, secondary metabolites and enzyme biochemistry in therapeutic applications and clinical diagnosis. The theoretical understanding of biochemical systems would certainly help to interpret the results of laboratory experiments.

Learning Outcomes

Having successfully completed this course, students will be able to:

- Learn the principles and application of enzymes therapeutic applications and clinical diagnosis and their mechanism of action.
- Understand about various modes of inhibition of enzyme actions with examples.
- Learn basics and applications of immobilization of enzymes, which includes; industrial production of antibiotics, beverages etc.
- Learn enzyme reactors and various parameters for bio-process design.
- Learn about the non-conventional sources of biocatalysts which include thermophilic and extremophilic microbes.

Course Contents:

Module I: Enzymes

Introduction and scope, Nomenclature, Mechanism of Catalysis, enzyme catalysis in organic media, Industrial applications.

Module II: Enzyme Kinetics

Single substrate steady state kinetics; King-Altman's method; Inhibitors and activators; Multi-substrate systems; Effect of pH and temperature; Allosteric enzymes. Thermodynamic explanation for transition complex formation, limitations of Michaelis – Menten equation, LB plot method to study enzyme kinetics, effect of pH **A**nd temperature on kinetics,allosteric enzyme kinetics,models as WMC, KNF with examples of ACTase and Hb.

Module III: Immobilization of Enzymes

Advantages, Carriers, adsorption, covalent coupling, cross-linking and entrapment methods, Micro-environmental effects

Module IV: Enzyme Reactors

Reactors for batch/continuous enzymatic processing, Choice ot reactor type: idealized enzyme reactor systems; Mass Transfer in Enzyme Reactors: Steady state analysis of mass transfer and biochemical reaction in enzyme reactors.

Module V: Bio-process Design

Physical parameters, reactor operational stability; Immobilized cells.

Module VI: Challenges and future trends

Catalytic antibodies and Non-protein biomolecules as catalysts, Biocatalysts from Extreme Thermoph!lic and Hyperthermophilic Archaea and Bacteria.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.

***References*:**

- Biotechnological Innovations in Chemical Synthesis, R.C.B. Currell, V.D. Mieras, Biotol Partners Staff, Butterworth Heinemann.
- Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis, R.A. Copeland, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig, John Wiley and Sons Inc

ADVANCED ANIMAL BIOTECHNOLOGY

Course Code: BMB 903 **Credit Units: 03**

Course Objective:

It aims to promote an understanding and knowledge of animal cell structure and function with particular emphasis on in vitro proliferation and differentiation.

Learning out comes:

After successful completion of the course student will be able to:

- Understand conventional and advanced aspects of Animal biotechnology.
- Learn the cell culture media, cell culture methods and their maintenance.
- Identify therapeutic enzymes, strategies of efficient enzyme replacement therapy methods.
- Understand concept of DNA vaccines and other vaccines using animal cell culture.
- Address the concepts and technology behind Gene therapy.
- Learn molecular mechanism of transgenic animal technology., Gene knockout tech.

Course Contents:

Module I
Introduction of animal cell culture-culture substrate, culture media, maintenance of cell lines. Stem cell Therapy: Methods and applications.

Module II
Enzyme therapy –introduction, therapeutic enzymes- Dnase I, adenosine deaminase, dihydrfolate reductase, streptokinase

Module III
DNA based vaccines, subunit vaccines, peptide vaccines, recombinant DNA vaccines, attenuated vaccines, vector vaccines.

Module IV
Gene therapy - SCID, cystic fibrosis, familial by hypercholestremia, prospects and problem, Biotechnological applications for HIV diagnostics and possible gene therapy for cancer.

Module V
Transgenic animal production and application in production of therapeutic proteins, gene Knock out and mice model for human genetic disorder, baculo virus for expression of foreign gene mapping of human genome

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss
- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag
- Cell Culture Lab FAx, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication

ADVANCED PLANT BIOTECHNOLOGY

Course Code: BMB 904 **Credit Units: 03**

Course Objective:

The plant biotechnology course basically meant for understanding the genomic organization, molecular & biochemical mechanism, Genetic engineering in plants and basic techniques of plant tissue culture in plants along with the latest ongoing research on the different aspects of plants.

Learning out comes:

After successful completion of the course student will be able to:

- Understand organogenesis, micropropagation, haploid and Embryo resue.
- Develop knowledge of cloning binary and expression vector, transformation in plants.
- Learn molecular techniques for identification of transgenics.
- Understand plant genome organization, gene families and delay of fruit ripening.
- Get knowledge of different biotic and abiotic stress resistant plant development.

Course Contents:

Module I: Plant Cell and Tissue Culture Techniques

Terms & definitions, History of Plant tissue culture, organogenisis embryogenesis and Micropropagation. Tissue Culture as a source of gentic variability- haploids and triploids plants and their utilization. Somaclonal variation, Embryo rescue and Endosperm culture with their practical applications,role of phytohormones, protoplast isolation and culture, somatic hybridization and cybridisation.

Module II

Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors. Mechanisms of T-DNA transfer to plants, Ti plasmid vector for plant transformation. Microprojectile bombardment mediated transformation. Electroproration, microinjection, Transgenics , Molecular techniques for the identification of transgenics. Protoplast transformation and chloroplast transformation

Module III

Plant genome organization, gene families in plants. Organization of chloroplast and mitochondrial genomes, chloroplast & mitochondrial encoded genes for their proteins, delay of fruit ripening

Module IV

Gene silencing in transgenic plants. Methods and strategies of Gene silencing, RNAi, (siRNA and mi RNA), Antisense RNA technology, etc

Module V

Insect resistance, pest resistance, herbicide, abiotic stress tolerance. Therapeutic proteins and compounds, secondary metabolites.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients bt T-J Fu, G. Singh and W.R. Curtis. Kluwer Adacemic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

DRUG DESIGN AND DEVELOPMENT

Course Code: BMB 905 **Credit Units: 03**

Course Objective:

The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

Learning outcomes:

By the end of the course the student will be able to:

- Know identification of drug targets, knowledge of binding site and receptors of a drug and their interaction.
- Identify the candidate drugs and design drugs that could be potentially useful in cell culture or animal models.
- Determine computer based selection, screening and rationale designing of drug.
- Get knowledge of combinatorial library and selection of the most effective compounds that could move through preclinical studies to clinical trials.
- Monitor of drug –target interaction by QSAR studies.

Course Contents:

Module I: Drug targets classification

DNA, RNA, Protein modifications/events, post-translational, processing enzymes, G proteincoupled receptors (monomeric transmembrane proteins), small molecule receptors, neuropeptidereceptors, ion channels (monomeric multi-transmembrane) proteins, ligand-gated ion channels (oligomerictransmembrane proteins), transporters (multi-transmembrane proteins).

Module II

Introduction to drug discovery and development, target discovery and validation strategies: Genomics (new target discovery), biological activity directed and other types of screening, combinatorial chemistry. Pharmacakinetics and Toxicological consideration.

Module III

Computer aided drug design, Structure-based design: 'de novo' design methodologies: docking.

Module IV

Design and development of combinatorial libraries for new lead generation: The molecular diversity problem, drug characterization – principles of equilibria, diffusion and kinetics,preformulation: pKa, partition coefficient, solubility, dissolution, chemical stability, and permeability,optimization of ADME characteristics, physico-chemical properties calculation, Linear Free energy, Hanseh equation, Hammett euation, chemiometrics in drug design.

Module V: QSAR

Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher
- Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher

References:

- Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.
- Principles of Drug Action, W.B. Pratt and P. Taylor, Churchill Livingston.
- Principles of Medicinal Chemistry, W.O. Foye, T.L. Lemke, and D.A. Williams, Williams and Wilkins
- Side Effects and Drug Design, E.J. Lien, Marcel Dekker.
- The Anticancer Drugs, W.B. Pratt, R.W. Ruddon, W.D. Ensminger, and J. Maybaum, Oxford University Press.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), W.M. Saltzman, Oxford University Press.
- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), A.J. Domb, J. Kost and D.M. Wiseman, Dunitz Martin Ltd.

DRUG DELIVERY SYSTEMS

Course Code: BMB 906 **Credit Units: 03**

Course Objective:

The course is to help the students in developing a detailed understanding of drug delivery system. After the completion of this course, the students are expected to be completely familiar with the different drug related aspects of a living body.

Learning outcomes

After successful completion of the course student will be able to:

- Understand the basic concepts of bioavailability, drug absorption, pharmacokinetics and pharmacodynamics.
- Analyze various routes of administration and associated evaluation parameters for oral, parenteral, topical etc. drug delivery systems.
- Gain knowledge of applications of novel drug delivery systems in various routes.
- Develop various novel treatments like gene therapy and antisense therapy.
- Develop an understanding to new generation technologies in drug delivery and targeting.

Course Contents:

Module I: Basic concepts of Drug Delivery

Introductory lecture, Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes,Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics.

Module II: Advanced Drug Delivery and Targeting

Basic terminologies in drug delivery and drug targeting, Drug release, Drug targeting, Doses forms, Variousroutes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basicprinciples).

Module III: Drug administration

Parenteral delivery- intravenous, inrtamuscular, interperetoneal. Oral delivery and systemic delivery throughoral route- structure and physiology of Gastro Intestinal tract, impediments against oral availability, advantages and disadvantages of oral drug delivery.Current technologies and new and emerging technologies in oral delivery. Nasal and pulmonary delivery, Ophthalmic delivery – structure and physiology of eye, topical and intraocular drug delivery, Drug targeting to CNS- Blood- Brain barrier, physiological and physiochemical factors fordelivering to CNS, current and new technologies in CNS delivery.

Module IV: Delivery of Genetic material

Basic principles of gene expression, Viral and nonviral vectors in gene delivery, Clinical applications of genetherapy and antisense therapy.

Module V: New generation technologies in Drug delivery and targeting

Nanotechnology / Nanobiotechnology, Use of biosensors and challenge of chronopharmacology, Microchipsand controlled drug delivery, genetically engineered cell implants in drug delivery.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Drug Delivery and Targeting by A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic
- Publisher.
- Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering), by W.M.
- Saltzman, Oxford University Press.

References:

- Handbook of Biodegradable Polymers (Drug Targeting and Delivery), by A.J. Domb, J. Kost and D.M.
- Wiseman, Dunitz Martin Ltd.
- Pharmaceutical Dosage Forms and Drug Delivery System by H.C. Ansel, L.V. Allen and N.G.
- Popovich, Lippincott Williams and Wilkins Publisher.

PHARMACEUTICAL BIOTECHNOLOGY

Course Code: BMB 907 **Credit Units: 03**

Course Objective:

The objective of this course to apply the basic concepts in the specific field of Pharmaceutical Biotechnology Industry. The student will gain insight into the working of a pharma industry, various classes of biotech products and the regulations governing production and marketing of pharmaceutical products.

Course Contents:

Module I

Introduction and History, Drug Discovery Process, Methods of Drug Discovery and development.

Module II

Physicochemical Properties in Relation to Biological Action – Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity.

Module III

DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics,Characterisation and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs**.**

Module IV

Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotecnhological products in clinical development

Module V: Regulations

Role of FDA, ICH Guidelines, cGMP, The Regulation of Pharmaceutical Biotechnological Products and Ethical Issues.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:

- Pharmaceutical Biotechnology - by Oliver. Kayser, Rainer Helmut Müller Series: Pharmaceutical Biotechnology , Vol. 9 Pearlman, Rodney; Wang, Y. John (Eds.) 1996,

References:

- Development and Manufacture of Protein Pharmaceuticals Series: Pharmaceutical Biotechnology , Vol. 14Nail, Steve L.; Akers, Michael J. (Eds.) 2002
- Pharmaceutical Biotechnology: Fundamentals and Applications, Third Edition, Editor Daan J.A. Crommelin, Robert D Sindelar.
- Pharmaceutical Biotechnology, Vyas, S. P., CBS Publishers & Distributors, 2002, Delhi

IPR, BIOSAFETY AND BIOETHICS

Course Code: BMB 908 **Credit Units: 03**

Course Objective:

The aim of this course is to develop the understanding of revelance, business impact and protection of Intellectual property along with the types of Intellectual Property Rights; Patents, Copyrights, Trademarks, Industrial Designs, Geographical Indications and International Conventions, Biosafety and Bioethics

Course Contents:

Module I
General Overview of Intellectual Property Rights, WIPO, WTO, Trade Related Intellectual Property Rights.

Module II
Patent - Basic requirements of Patentability, Patentable Subject Matter, Procedure for Obtaining Patent, Provisional and Complete Specification

Module III
Copyright - Objectives of copyright, Rights conferred by registration of copyright, Infringement of copyright

Module IV
Trademarks-Basic Principles of Trademark, Rights conferred by Registration of Trademark, Infringement of Trademark

Module V
Geographical Indications-Objectives of Geographical Indications, Rights conferred, Infringement of Geographical Indications, International Position, Indian Position, Bioprospecting and Biopiracy.

Module VI
Biosafety and Bioethics Management-Key to environmentally responsible use of biotechnology. Cartagena Protocol on Biosafety, Ethical implications of Biotechnological products and techniques.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

Text:
- Intellectual Property Rights by Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries by Graham Dutfield, Ashgate Publishing

References:
- WIPO Intellectual Property Handbook
- Intellectual Property Rights by William Rodelph Cornish, David Clewelyn
- Journals and Current magazines

CLINICAL BIOTECHNOLOGY

Course Code: BMB 909 **Credit Units: 03**

Course Objective:

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

Course Contents:

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease.Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases. Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteris, Staphylococci, Streptococci etc. Isolation and identification strategies.

Aetiology-identification of disease agents and their source, transmission, portals of entry, noscomial infections. Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods. Hygiene regulations, population screening for disease.Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases, transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Module V

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module VI

Management of Clinical Data.

Module VII: Biosensors

Definition, History, Properties of biosensors, Design features of Biosensors, The Biological Component, SignalTransduction: Amperometric Biosensors, Potentiometric Biosensors, Detection of H+ cation, Detections ofNH^{4+} cation, Detection of CN- anion, Calorimetric biosensors, Optical Biosensors, Measuring the change inlight reflectance, Measuring luminescence, Pizo-electric biosensors, Immunosensors, Commercial examples of biosensors. Biosensors markets- Opportunities and obstacles.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), LubertStryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

NANOBIOTECHNOLOGY

Course Code: BMB 910 **Credit Units: 03**

Course Objective:

Nanotechnology is one of the most important emerging fields in today's scenario and holds tremendous potential in the field of Biotechnology. The objective of this course is to introduce this emerging field to the students so that they can apply this to develop new drug delievery systems and biomarkers.

Course Contents:

Module I: Introduction to Nanotechnology

Overview of nanotechnology developments, different nanostructured materials, properties related to nanostructured surfaces, the rules governing the health and safety standards related to the use of chemicals and nanomaterials and the physical environment required for working with nonmaterials. laws and principles governing the functions of numerous instruments found in nanobiotechnology. atomic theory and bonding, quantum theory, electromagnetic properties of matter, molecular structure and macromolecules, intramolecular and intermolecular forces, solubility and solvation, thermodynamics and fluid behaviour.

Module II: Nanostructured Materials

The choice of nanomaterials to be used in the context of a bionanostructured system for either development or production. carbon nanotubes and nanowires, the physical characteristics of nanomaterials and nanostructured surfaces, quantum dots, nanostructured thin films, pattern sufaces, composites, mangnetic nanoparticles, scaffolds, gels and drug delivery systems.

Module III: Nanobiostructure Systems – Drug Delivery

The assembly of drug delivery systems, preparation and assembley of pharmaceutical molecule into nanometric material within the parameters of GLP and health and safety standards.

Module IV: Nanobiostructure Systems - Biosensor

The functional assembling of the components of a nanostructured biosensor, putting together a bioreceptor and putting together nanometric support and a signal transduction system. Assembly and production of a nanobiosensor.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Molecular Engineering of Nanosystems by Edward A. Rietman.
- Nanobiotech- Concepts, Applications and Perspectives, Christot, Chad Mirkin.
- Nanoscale Science and technology, Robert W Kelsall, Mark Geoghegan, Ian W Hamley.
- Nano surface chemistry, Morton Rosoff.

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Course Code: BMB 911 **Credit Units: 03**

Course Objective:

The course aims to provide an understanding of the concept of entrepreneurship in Biotechnology. Basics of management, operations, marketing and Government Regulations for Biotech products. The theoretical understanding will help setup and working in biotech related industries.

Module I

1. Creativity and Entrepreneurial personality and Entrepreneurship in Biotechnology
2. Organizational Structure and management
3. Capital Management
4. Product innovation and management
5. Government schemes for commercialization of technology (Eg. Biotech Consortium)

Module II

1. Basics of production management: Methods of manufacturing-Project/ jobbing, Batch production, process production-Characteristics of each method, Plant location-Importance-Factors affecting location-Factory building-Plant layout-Installation of facilities.
2. Operational research: Linear programming, PERT and CPM; Production planning and Control – Scheduling-Gantt Charts-Documentation-Production-Work Order.
3. Basics of material management

Module III

1. Kaizen { Continuous improvement in product and management }
2. Six Sigma
3. Biotech enterprises: Small, Medium and Large.
4. Quality control in Biotech industries.

Module IV

1. Government Regulations for Biotech product.
2. Public Policy, Regulatory and ethical challenges facing the Biotechnology entrepreneurship.
3. Business development for medical products.
4. Business development for consumable products.

Module V

1. Patenting System: WTO, Pans Convention, Indian Legislations
2. Intellectual Property: A Copy Right and Industrial Properties, Trade Marks, Design. Geological Indications
3. Patent process and Patent laws and e-filling.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & Reference :

1. Innovation and Entrepreneurship in Biotechnology: Concept, Theories and Cases by Hyne& Others
2. John Kapeleris, 2006
3. The business of Biotechnology: From the bench to the Street: by Richard Dano Ono, published by Butterworth-Heinemann, 1991
4. Entrepreneurship in Biotechnology: Managing for Growth from start up: By Martin

.ADVANCED IMMUNOLOGY LAB

Course Code: BMB 920 **Credit Units: 01**

Course Contents:

1. Purification of immunoglobin G.
2. Study of antigen- antibody pattern (ODD).
3. Study of sandwich ELISA.
4. Study of haemeagglutination.
5. Study of immunoelectrophoresis.
6. Isolation and identification of rosette cells.
7. Antigen capture ELISA

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

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ENZYME TECHNOLOGY LAB

Course Code: BMB 921 **Credit Units: 01**

Course Contents:

Module I

Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organismand also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

Module II

Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

Module III: Downstream processing

Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

Module IV

Isolation of Enzymes from plant and microbial sources.
Enzyme assay; activity and specific activity – determination of amylase, nitrate reductase, cellulose, protease.
Purification of Enzyme by ammonium sulphate fractionation.
Enzyme Kinetics: Effect of varying substrate concentration on enzyme activity
Effect of Temperature and pH on enzyme activity.

Module V

Production of enzyme on industrial scale using solid and state fermentation
Enzyme immobilization

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED ANIMAL BIOTECHNOLOGY & PLANT BIOTECHNOLOGY LAB

Course Code: BMB 922 **Credit Units: 01**

Course Contents:

ADVANCED ANIMAL BIOTECHNOLOGY

1. Histological study of important animal tissues.
2. Estimation of enzyme activity from animal tissues.
3. Study of toxicity on invitro model.
4. Culture and maintenance of animal cell lines.
5. Culture of chickenfibroblasts.
6. Invitro expression of proteins in animal cell lines.

PLANT BIOTECHNOLOGY

1. Tissue culture lab and organization.Sterilisation of glasswares, tools and equipments.
2. Preparation of stocks and media.Surface sterilization of various explants
3. ORGAN CULTURE
4. Cllus culture
5. Anther culture
6. Embryo culture, Protoplast isolation and culture

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ADVANCED COMMUNICATION –IX

Course Code: BCP 941 **Credit Units: 01**

Course Objective:

The course is designed to develop competence in communication skills related to production & presentation of messages in multiple formats & understand the importance of body language.

Prerequisites: NIL

Module I Written Communication	**40% Weightage**
• Coherence and Structure • Précis Writing • Writing Paragraphs & Essays	
Module II Developing Writing Skills	**30% Weightage**
• Business Letter/Official Correspondence • Social Correspondence • Emails & Netiquette	
Module III Business Presentations	**30% Weightage**
• Planning, Design and Layout of Presentation • Contents : Information Packaging & Delivery • Personal Branding	
Student Learning Outcomes	
The student will be able to write impressive official correspondence and also learn to make and give effective presentations in a professional environment.	
Pedagogy for Course Delivery • Workshop • Presentation • Group Discussion • Lectures	

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text:

Raman Prakash, Business Communication, 2nd ed. Delhi OUP 2006
Comfort , Jermy Speaking Effectively, Jermy, et.al, Cambridge, CUP, 1994
Lesikar & Flatley, Basic Business Communication, Tata McGraw- Hill Edition

Reference:

Guffey, Ellen Mary, Business Communication, Thomson (South Western)
Business Communication for Managers, Payal Mehra Pearson 2012
Additional Reading: Newspapers and Journal

BEHAVIOURAL SCIENCE – IX

Course Code: BSP-943 **Course Credit: 01**

Total Hours: 1

Course Objective:

This course will help the students to:

- Importance of Personal and Professional excellence
- Inculcating the components of excellence
- Explore interest, attitude and Explore career opportunities
- Set career goals

Course Contents:

Module I: Professional Competence **(2 Hours)**

- Understanding Professional Competence
- Component of Competence:
  - Knowledge
  - Skills
  - Attitude
  - Self awareness
  - Self Promotion & Presentation,
  - Self confidence
  - Skills
  - Performance
- Political awareness, Coping with uncertainty
- Developing positive attributes at work place (personal and professional)
- Time management
- Handling criticism and interruptions
- Managing difficult people

Module II: Managing Personal Effectiveness **(2 Hours)**

- Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness)
- Integration of personal and organizational vision for effectiveness
- A healthy balance of work and play

Module III: Components of Excellence **(2 Hours)**

- Positive Imagination & Focused
- SMART Goal
- Controlling Distraction
- Commitment
- Constructive Evaluation
- Creativity & Success

Module IV: Career Development **(2 Hours)**

- Understanding Development Process
- Knowing and assessing one’s Interest
- Knowing and assessing one’s Aptitude
- Selecting from available resources
- Career planning and development

Module V: Personal & Professional Success **(2 Hours)**

- Career Selection & Motivation.
- Action planning Networking Negotiation.
- Accept Change & Challenge for Successful career.

Student learning outcomes:

- Students develop the ability to identify their strengths and weaknesses.
- Students will know how to develop positive healthy relationship.
- Students will know how to manage their daily life conflicts.
- Students will know how to be resilient during stressful situations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers
- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan, D. (2005). Information and Knowledge Management, Macmillan India Ltd. Delhi

Français-IX

CourseCode:FLP 944 **CreditUnits:02**

CourseObjective:

Tofurnishthelinguistictools
_ totalkaboutwork andproblemsrelatedtowork
_ toperform simple communicative tasks(explaininga setback,askingforapostponementofappointment,give instructions,place orders,reserve, holda telephone conversation,write e-mails,replytomessages)
_ toprepare arésumé andtoappearforinterviews

CourseContents:

Unité 5, 6:pp. 74to104

Actesde communication:

Unité 5:Travail

1. mangeraurestaurant,comprendreunmenu,commander
2. engagerune conversationtéléphonique
3. présentersonrésumé: parlerde sa formation,de sonexpérience,de ses compétences
4. raconterdesévénementspassés
5. consultersa boîte e-mails,répondreauxmessages

Unité 6:Problèmes

1. identifierunproblème,demanderdesprécisions
2. expliqueruncontretemps,déplacerunrendez-vous
3. demanderde l'aide (partéléphone,pare-mail)
4. donnerdesinstructions
5. expliquerunproblème,suggérerunesolution.

Grammaire :

1. futur proche, articles partitifs, un peu de, beaucoup de, une bouteille de, Un morceau de.
2. pronoms COD, venir de + infinitif, verbes appeler (au présent)
3. passé composé avec avoir, affirmatif et interrogatif, savoir et connaître
4. passé composé avec être, accord du participe passé, négation
5. pronoms COI, être en train de
6. ne…rien, ne…personne, ne…plus, ne…pas encore, qu'est-ce que/ qu'est-ce qui/qui est-ce que/qui est-ce qui.
7. passé composé des verbes pronominaux.
8. si/quand+présent, ne…plus, ne …pas encore.
9. impératif présent (2) place du pronom et verbes pronominaux.
10. Trop /pas assez, verbe devoir au conditionnel présent.

Examination Scheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage (%)	15	10	5	**30**	**70**	**100**

Text&References:

Le livre àsuivre: Penfornis, Jean-Luc.Français.Com(Débutant). Paris: Clé International, 2007.

SUMMER INTERNSHIP

Course Code: BMB 950 **Credit Units: 12**

GUIDELINES FOR SUMMER TRAINING

The main objective of summer training is to familiarize students to laboratory environment and make them learn to handle equipments and softwares, design experiments and analyze the results. The student will be supervised by one or more faculty members and he or she will be required to submit a synopsis. While writing a synopsis emphasis should be given to make it publishable. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography
Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).
Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report
2.1 Report Size
The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size
The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing
It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material
Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding
First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report
After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font
For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins
A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing
The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Review of Literature and Definition of Problem**

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion and Future prospects**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Summary**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1

(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION

(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.3 Heading

(Main Heading: Times New Roman, 16 Pts., Bold)

1.3.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.3 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½” space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.. Evaluation will compose of two components - Project report assessment and Viva - voce. Project report assessment will be done by the two internal faculty members in respective fields. A committee of three faculty members will conduct Viva-voce.

Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project will be assessed as per evaluation format.

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

PROJECT

Course code: BMB 1060 **Credit Units: 30**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:
The report should be hard bound and for color coding scheme refer NTCC guidelines.
It should contain the following components:

- Number of pages and color

Keep the total number of pages (of the chapters) between 50 and 80, not exceeding 80 in any case.
This does not include the page count of the appendices.
With regard to the text please note:
Color: Black on white
Typing: One side

- Spacing and Margin

All text, drawings, tables, etc., must be positioned on an A4 sheet with 1 in. margin on the top, bottom and right side and 1½ in. margin on the left side.

Use 1.5 lines spacing with material typed.

Single spacing should be used for typing:
(i) Long Tables
(ii) Long quotations
(iii) Foot notes
(iv) Multilane captions
(v) References

- Font

Font style and size: Times New Roman, 12 pt. For font size of chapter, section and subsection use headings.

A sub-heading at the bottom of a page must have at least two full lines below it or else it should be carried over to the next page. The last word of any page should not be split using a hyphen.

The dissertation report should be prepared on good quality white paper preferably no lower than 80gsm.

- Page Numbering

- Pages should be numbered at bottom center (including pages that contain only figures or tables).

1 Beginning with the first page of the text of the dissertation (chapter 1), all pages should be numbered consistently in Arabic numerals throughout the dissertation, including appendices.

2 Page indications before Chapter 1 should be done in lower case Roman numerals. The title page is considered to be page i, but the number is not typed.

- Tables, Figures and Equations

Figures and Tables

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 20 figures in chapter 1 spread over all of its sections the figure numbers should run from Figure 1.1 through Figure 1.20.

In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.

Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

If tables and figures are of size half a page or less, they may appear on the same page as text but separated above and below by triple line spacing.

- Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

In general, Dissertation report should be comprehensive and include:

Title or Cover Page

The title page should contain the following information: Dissertation Title; Students Name; Course; Year; Supervisor's Name.

(Cover Page and first page inside the report must be same)

Declaration

Certificate

Certificate on Organizations Letter Head (if dissertation is carried outside)

Acknowledgements

Acknowledgment to any advisory or financial assistance received in the course of work may be given. The Acknowledgement shall be brief and should not exceed one page. The scholar's signature shall be made at the bottom end above his./ her name typed in capitals.

Abstract

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the dissertation work, but rather a concise summary of the scope and results of the dissertation work. The abstract (about 250 words) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.

Table of Contents

Include page numbers indicating where each chapter / section begins. Chapter / section are to correspond exactly with those in the text. List of Figures and List of Tables should be on separate pages. Each list should give, in tabular form, the figure or table number, its title/caption and its page number.
The list should use exactly the same captions as they appear in the text. List of Symbols, abbreviations and Nomenclature- One and a half spacing should be adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used.

Introduction

Here a brief introduction to the problem that is central to the dissertation work and an outline of the structure of the rest of the dissertation should be provided. It is the first chapter of the Dissertation. The purpose of an introduction in the Dissertation is to justify the reasons for writing about the report. The goal in this section is to introduce the topic to the reader, provide an overview of previous research on the topic, and identify the own hypothesis. It can be noted here that the introduction should not contain every bit of detail in the report, and it should not include support for the report. An introduction might, however, include the reasons for supporting the report.
The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Literature Review

Literature survey/review is the documentation of a comprehensive review of the published and unpublished work from secondary data sources. The library is a rich storage base for secondary data and researchers can go through books, journals, newspapers, magazines, conference proceedings, doctoral theses, master's dissertations, government publications and financial reports to find information on their research topic. With computerized databases now readily available and accessible the literature search is much speedier and easier and can be done without entering the portals of a library building. Survey of literature related to the dissertation work e.g. research papers published in national and international journals, conferences, related books, websites is very important to get hold of the dissertation topic.

Design and Implementation

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Approach to design

A design approach will guide you to achieve the overall goal of the design. The key to design approach is clear understanding of what you want to achieve. The basic idea of the design approach is to understand the context in and the constraints under which a design solution will be produced.

For finding an appropriate design approach you need to:

- Investigate possibilities and constraints
- Define problem spaces
- Build and redefine the specifications of design solutions to test the ideas in a real world context
- Prototype/Simulate possible scenarios that can incrementally or significantly improve the inherited situation
- Understanding the current style and trend

Simulation/Experimentation

The act of simulating something generally entails representing certain key characteristics or behaviors of a selected physical or abstract system. Simulation is used in many contexts, such as simulation of technology for performance optimization, testing and verification of results. If the dissertation involves the usage of a particular software tool e.g MATLAB, VHDL or a programming Language like C, JAVA, then the simulated results as well as a brief overview of the tool or features of the language should be presented in the dissertation.
In case the dissertation work involves hardware tools and equipments, a brief summary of the specifications and experimentation results should be presented.

Experiments should measure:

- Pure running time
- Sensitivity to important parameters
- Scalability in various aspects: data size, problem complexity

Experiments should show:

- Absolute performance (i.e., it's acceptable/usable)
- Relative performance in comparison to previous approaches
- Relative performance among different proposed approaches

Discussion of Results

The purpose of Discussion is to interpret the results in light of what was already known about the topic of the dissertation, and to explain new understanding of the problem after taking the results into consideration. It should discuss the implications of those results.

The Discussion will always connect to the Introduction, but it does not simply repeat or rearrange the Introduction. Instead, it tells how the study has moved forward from the place it left, at the end of the Introduction.

It can include:

- What can be the next step in the dissertation work , e.g., what experiments would you do next?
- Organize the Discussion to address each of the experiments/studies for which results were presented.
- Consider how the results of others studies may be combined to derive a new or perhaps better substantiated understanding of the dissertation work.

In writing this section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books.

Presentation of Results and their analysis

An integrated results analysis is crucial for a dissertation work. Student with his insight and understanding of the goals, strategies, environments, and challenges of the dissertation work can analyze and put the results in context. While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion result; it should lead to generalization of data on the chosen sample.

The integrated results analysis should satisfy the following guidelines. It should:

- be relevant and significant
- be comparable to the existing references.
- be presented in a clear and understandable format.
- focus on results and achievements
- compare planned to actual results
- describe variations and uncertainties
- include simulation and experimentation results
- if analysis is made under any assumptions, they should be clearly described

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly. Check that your work answers the following questions:

Did the research work meet its aims (check back to introduction for stated aims)? What are the main findings of the research?

Are there any recommendations?

Future prospects

State the aspects of the problem that have not been considered and possibilities for further enhancements. This section shows how the work done can set new research directions. If you're actively engaged in follow-up work or plan to pursue further work on the subject, mention that.

Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the dissertation and any problem that have arisen that may be useful to document for future reference.

References / Bibliography

References:

Referencing is necessary to avoid plagiarism, to verify quotations and to enable readers to follow-up. Indicate references by number(s) sequentially in square brackets [ ] in the order in which they appear in the text.

Examples:

For Journals

[1] J. F. Fuller, E. F. Fuchs, and K. J. Roesler, "Influence of harmonics on power distribution system protection," IEEE Trans. Power Delivery, vol. 3, pp. 549-557, Apr. 1988.

For Books:

[2] E. Clarke, Circuit Analysis of AC Power Systems, vol. I. New York: Wiley, 1950, p. 81.

[3] G. O. Young, "Synthetic structure of industrial plastics," in Plastics, 2nd ed., vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.

For Technical Reports:

[4] E. E. Reber, R. L. Mitchell, and C. J. Carter, "Oxygen absorption in the Earth's atmosphere," Aerospace Corp., Los Angeles, CA, Tech. Rep. TR-0200 (4230-46)-3, Nov. 1968.

[5] S. L. Talleen. (1996, Apr.). The Intranet Architecture: Managing information in the new paradigm. Amdahl Corp., Sunnyvale, CA. [Online]. Available: http://www.amdahl.com/doc/products/bsg/intra/ infra/html

For Conference Proceedings

J. L. Alqueres and J. C. Praca, "The Brazilian power system and the challenge of the Amazon transmission," in Proc. 1991 IEEE Power Engineering Society Transmission and Distribution Conf., pp. 315-320.

For Dissertations:

[7] S. Hwang, "Frequency domain system identification of helicopter rotor dynamics incorporating models with time periodic coefficients," Ph.D. dissertation, Dept. Aerosp. Eng., Univ. Maryland, College Park, 1997.

For Standards:

[8] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C57.19.100-1995, Aug. 1995.

For Patents:

[9] G. Brandli and M. Dick, "Alternating current fed power supply," U.S. Patent 4 084 217, Nov. 4, 1978.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	50
Viva Voce	50
Total	**100**

AMITY UNIVERSITY
M A D H Y A P R A D E S H

Bachelor of Science Biology

Programme Code: BSC

Duration – 3 Years Full Time

Programme Structure
And
Curriculum & Scheme of Examination

Batch: 2021 -2024

AMITY UNIVERSITY
MADHYA PRADESH
PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

The programme is enabled with wide range of teaching and learning methods including, class room sessions, seminars, quizzes, industrial and academic visits, workshops, guest lectures etc., to further capacity building of the students.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is belief that the provided information will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

July 2021

PROGRAMME OBJECTIVE

B.Sc. (Biology) is three year degree programme spread into six semesters, which offers perfect combination of core basic biological sciences courses along with chemistry with emphasis on advanced techniques in the area of biology that are holding importance not only in basic science research but also for industrial relevance. The programme is structured to impart knowledge and skills to young students to build up strong theoretical and practical knowledge to strengthen the research and development in biological science and develop excellent professionals for academics, research institutions and industries.

The last semester of curriculum is primarily dedicated to dissertation (A small full time research project) which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative.

The curriculum imparts training in both fundamental of basic biology and its applied aspects. Each subject of the programme besides focusing on theoretical aspects, it is also adequately supported by practicals conducted in well equipped laboratories. This programme offers some of the core subjects of biological sciences under the broad subject category of like Zoology, Botany, and Chemistry which consisting of Taxonomy, Diversity, Developmental biology, Physiology, Biochemistry, Cell biology, Reproduction and Biotechnology for animal as well as plants. The major highlight of the course is the extensive discussion of the life forms and various domains of living processes of plant, animal and microbes. The programme has a well conceived curriculum so as to fulfill the requirement for higher academic pursuits in Biological sciences.

PROGRAMME STRUCTURE (B.Sc. Biology)

FIRST SEMESTER

Course Code	Course Title	Lecture (L) Hours Per week	Tutorial (T) Hours Per week	Practical (P) Hours Per week	Total Credit	Page No.
Compulsory Courses						
BSC101	Plant Sciences – I	4	-	-	4	
BSC102	Animal Sciences-I	4			4	
BSC103	Chemistry – I	4	1	-	5	
BSC120	Plant Sciences Lab - I	-	-	4	2	
BSC121	Animal Sciences Lab-I	**-**	**-**	**4**	**2**	
BSC122	Chemistry Lab – I	-	-	4	2	
EVS142	Environmental Studies - I	2	-	-	2	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU141	Communication Skill - I	30	-	-		
BSU143	Behavioural Science - I	30	-	-		
	Foreign Language - I	30	-	-		
FLU 144	French - I					
FLU 145	German					
FLU 146	Spanish					
FLU 147	Japanese					
FLU 148	Chinese					

SECOND SEMESTER

Compulsory Courses						
BSC201	Plant Sciences – II	4	-	-	4	
BSC202	Animal Sciences-II	4	-		4	
BSC203	Chemistry – II	4	1	-	5	
BSC220	Plant Sciences Lab – II	-	-	4	2	
BSC221	Animal Sciences Lab-II	**-**	**-**	**4**	**2**	
BSC222	Chemistry Lab – II	-	-	4	2	
EVS242	Environmental Studies - II	1	-	-	1	
	TOTAL				**20**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU241	Communication Skill - II	30	-	-		
BSU243	Behavioural Science - II	30	-	-		
	Foreign Language - II	30	-	-		
FLU 244	French - II					
FLU 245	German					
FLU 246	Spanish					
FLU 247	Japanese					
FLU 248	Chinese					

TERM PAPER: 4 – 6 WEEKS

THIRD SEMESTER

Compulsory Courses						
BSC301	Anatomy & Plant Physiology	4	-	-	4	
BSC302	Animal Physiology-I	4	-	-	4	
BSC303	Chemistry – III	4	1	-	5	
BSC320	Anatomy & Plant Physiology Lab	-	-	4	2	
BSC321	Animal Physiology Lab-I	-	-	4	2	
BSC322	Chemistry Lab – III	-	-	4	2	
BSC 330	Term Paper (Evaluation)	-	-	-	2	
	TOTAL				**21**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU341	Communication Skill - III	30	-	-		
BSU343	Behavioural Science - III	30	-	-		
 FLU 344 FLU 345 FLU 346 FLU 347 FLU 348	Foreign Language - III French - III German Spanish Japanese Chinese	30	-	-		

FOURTH SEMESTER

Compulsory Courses						
BSC401	Plant Breeding, Embryology, Pathology & Economic Botany	4	-	-	4	
BSC402	Animal Physiology-II	4	-	-	4	
BSC403	Chemistry – IV	4	1	-	5	
BSC420	Plant Breeding, Embryology, Pathology & Economic Botany Lab	-	-	4	2	
BSC421	Animal Physiology Lab-II	**-**	**-**	**4**	**2**	
BSC422	Chemistry Lab-IV			4	2	
	TOTAL				**19**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU441	Communication Skill - IV	30	-	-		
BSU443	Behavioral Science - IV	30	-	-		
 FLU 444 FLU 445 FLU 446 FLU 447 FLU 448	Foreign Language - IV French - IV German Spanish Japanese Chinese	30	-	-		

FIFTH SEMESTER

Compulsory Courses						
BSC501	Plant Biotechnology	4	-	-	4	
BSC502	Genetics & Animal Biotechnology	4	-	-	4	
BSC503	Chemistry – V	4	1	-	5	
BSC520	Plant Biotechnology Lab	-	-	4	2	
BSC521	Genetics & Animal Biotechnology Lab	-	-	4	2	
BSC522	Chemistry Lab V	-	-	4	2	
BSC 550	Summer Training				23	
	TOTAL				**42**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU 541	Communication Skill - V	30	-	-		
BSU 543	Behavioural Science - V	30	-	-		
 FLU 544 FLU 545 FLU 546 FLU 547 FLU 548	Foreign Language - V French - V German Spanish Japanese Chinese	30	-	-		

SIXTH SEMESTER

Compulsory Courses						
BSC601	Plant Ecology	3	1	-	4	
BSC602	Applied Zoology	3	1	-	4	
BSC603	Chemistry – VI	3	1	-	4	
BCH623	Principles of Management & Entrepreneurship Development	2	-	-	2	
BSC620	Plant Ecology and Applied Zoology Lab	-	-	4	2	
BSC621	Chemistry Lab VI	-	-	4	2	
BSC 660	Project (10-12 Week)		-	-	12	
	TOTAL				**30**	
Optional Courses - Value Added Courses; Any Three [Hours/Sem]						
BCU641	Communication Skill – VI	30	-	-		
BSU643	Behavioural Science – VI	30	-	-		
 FLU 644 FLU 645 FLU 646 FLU 647 FLU 648	Foreign Language -VI French - VI German Spanish Japanese Chinese	30	-	-		

Plant Sciences - I

Course Code: BSC 101 **Credit Units: 04**

Course Objective:
The objective of this course is to familiarize the students with the classification, morphology, reproduction and economic importance of various groups of lower plants which will provide the basic knowledge for the employment of these plants to study plant biotechnology.

Learning Outcome

1. The students will be able to identify basic concepts of algal plants morphology, anatomical features, evolutionary pathways & mode of reproduction.
2. Understand the role of algae in freshwater, marine and soil environments as primary producers, suppliers of nutrition to animals and as resources for humans.
3. Study and acquire knowledge about the occurrence, distribution, structure, phylogeny, evolutionary concepts and life history of fungi, lichens & mycorrhiza.
4. Have a good overview of the general morphology, diversity, distribution, sexual reproduction, diversity of bryophytes, the significance of bryophytes as pioneer plants on land and their role in the origin of pteridophytes.

Course Contents:

Module I: Algae

Fritsch Classification, occurrence, structure, systematic position mode of reproduction and economic importance of the following genera:
Chlamydomonas,,Chara, Sargassum, Polysiphonia, Nostoc.

Module II: Fungi

Outlines of classification of fungi, position, occurrence, structure and mode of reproduction in fungi, based on the following representatives:,*Eurotium*, *Morchella*, *Agaricus*and *Alternaria*, Economic importance of fungi, Lichens: Classification, occurrence, systematic position, mode of nutrition, reproduction and economic importance, Mycorrhiza: Systematic position, general mode of reproduction and economic importance.

Module III: Bryophytes

Outlines of classification and importance of bryophytes, Systematic position occurrence, morphology, anatomy and reproduction in, *Marchantia, Anthoceros (*Development of Sporophyte only).

Module IV: Pteridophytes

Systematic Position, occurrence, morphology, anatomy and development of reproductive structures of *Selaginella, Equisetum* and *Marsilea*, Stelar system and its evolution in Pteridophytes, Heterospory and seed habit.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- College Botany Vol. I and II, Ganguli and Kar
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain

References:

- The Algae, V. J. Chapman and D. J. Chapman.
- Introductory Phycology, H. D. Kumar.
- A Text Book of Algae, H. D. Kumar and H.N. Singh.
- Introductory Mycology, Alexopaulos and Mims
- Cryptogamic Botany, G. M. Smith.

Animal Sciences - I

Course Code: BSC 102 **Credit Units: 04**

Course Objective: The main objective of this course is to introduce characteristics and variation among different phylum of Invertebrates from Protozoa to Echinodermata.

Learning Outcome

After successful completion of the course student will be able to:

- Learn about characteristics and variations of invertebrates.
- Develop scientific outlook for research and innovation.
- Get knowledge of typical invertebrates and their economic importance.
- Develop conservative outlook for animals.
- Generate written and verbal communication skills over the subject.

Course Contents:

Module I: Diversity among Invertebrates: Concept of species,Binomial nomenclature, classification-Hierarchy.

-Salient features and out line classification of various phyla of lower and higher invertebrates upto class with suitable examples (According to Parker and Haswell latest edition).

Module II:

-Protozoa: Type study of *Plasmodium.*

-Porifera: Type of *Sycon.*

Module III

-Coelnterata: Type study of *Ovelia.*

-Helminthes: Type Study of *Liverfluke.*

Module IV: Higher Invertebrates

-Annelida: Type study of *Pheretima (Earth worm) and Vermicomposting,*

-Arthropoda: Type Study of *Prawn*

Module V:

Mollusca: Type Study of *Pila*

Echinodermata: External features of Star fish and Echinoderm larvae

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Jordan, E.K. and Verma, P.S., Invertebrate Zoology. S. Chand & Co. New Delhi.
- Kotpal, R.L., Refer to the series on Protozoa, porifera, Coelentrta, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publication, Merrut.
- Borradile, L.A. and Potts, F.A., Invertebrate Zoology, Cambridge Press, UK.
- Dhami, P.S. and Dhami, J.K., Invertebrate Zoology, S Chand & Co. New Delhi.

- Kotpal R.L., Text book of zoology: Invertebrates, Rastogi publication.

CHEMISTRY - I

Course Code: **BSC 103** **Credit Units: 05**

Course Objective:

The objective of this course is to educate the students about molecules, their energy to form bonds, metallurgy of elements, kinetic theory of gases, Vander walls equation and also enzymatic catalysis

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic bonding mechanism and the application to materials in different field.
- To understand the Chemical properties and basic bonding behavior of Radioactive elements
- To understand the Chemical properties and basic bonding behavior of inorganic chemistry elements
- To understand the Chemical Kinetics, Gas Kinetics, Gas behavior, rate of reaction

Course Contents:

INORGANIC

Module I

Chemical bonds and molecules,Shapes of simple molecules, bond energy, bond length, resonance and Hydrogen bond.

Module II

Radioactivity**:** Natural and artificial, group displacement law, half life period, binding energy, nuclear reaction equations, isotopes, tracers, radio dating, Application of radioactivity.

Module III

Periodic table**:** Modern periodic table, periodicity in properties of elements, atomic radii, ionic and covalent radii, ionization energies, electron affinity, electro-negativity.

Module IV

Metallurgy of S block elements (Na, K, Be, Mg, Ca)

PHYSICAL

Module V

Gases: Kinetic theory of gases, Vander Waal's equation, critical constants, Liquefaction of gases**.**

Module VI

Chemical-Kinetics: Velocity of a reaction, Law of mass action; determination of rate constants for first and second order reactions, collision theory of bimolecular reactions.
Catalysis: Promoters and Poisons, Enzyme catalysis.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand & Co. Ltd.
- Text book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd**.**
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

Plant Sciences Lab - I

Course Code: BSC 120 **Credit Units: 02**

Course Contents:

Module I: Algae
Study of Algal types with the help of permanent slides and also by preparingsuitable slides as prescribed in the theory course. (Chlamydomonas,,Chara, Sargassum, Polysiphonia,)

Module II: Fungi
Study of Fungal types with the help of permanent slides and also by preparing suitable slides as prescribed in the theory course. (Eurotium, Morchella, Agaricus)

Module III: Bryophytes
Study of Bryophytes like Riccia,Marchantia ,Anthoceros with the help of permanent slides and also by cutting sections and making suitable preparations.

Module IV: Pteridophytes
Study of the pteridophytes like Selanginella, Equisetum, and Marsilea with the help of permanent slides and also by cutting sections and making suitable preparations.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Sciences Lab- I

Course Code: BSC 121 **Credit Units: 02**

- Study of museum specimens and slides, related to various phyla of invertebrates
- Preparation of slides of amoeba, paramecium.
- Dissection of earthworm and digestive system of earth worm
- Dissection of cockroach and glycerin preparation of mouth parts.
- Dissection of Pila.
- Use specimens and permanent slides.

CHEMISTRY LAB - I

Course Code: BSC 122 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I

Volumetric analysis: Oxidation-reduction titration using $KMnO_4$ and $K_2 Cr_2 O_7$

Module II

Iodometry titrations: Estimation of sodium thiosulphate& potassium dichromate.

Module III

Preparation of the following inorganic compounds: Prussion blue from iron fillings, chrome alum, cuprous chloride and potassium trioxalatrochromate.

PHYSICAL CHEMISTRY

Module IV

Determination of surface tension and viscosity of liquids

Module V

Heat of neutralisation of a strong acid and a strong base.

Module VI

Solubility curve of KNO_3 or benzoic acid.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-I

Course Code: BCU 141 **Credit Units: 1**

Course Objective:

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Essentials of English Grammar**	**30% Weightage**
	• Common Errors • Parts of Speech • Collocations, Relative Pronoun • Subject-Verb Agreement • Articles • Punctuation • Sentence Structure- 'Wh' Questions	
2.	**Module II Written English Communication**	**30% Weightage**
	• Paragraph Writing • Essay Writing	
3.	**Module III Spoken English Communication**	**30% Weightage**
	• Introduction to Phonetics • Syllable-Consonant and Vowel Sounds • Stress and Intonation	
4.	**Module IV : Prose**	**10% Weightage**
	"Friends, Romans, Countrymen, lend me your ears" Speech by Marc Antony in Julius Caesar ❖ Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Identify Common Errors and Rectify Them • Develop and Expand Writing Skills Through Controlled and Guided Activities • To Develop Coherence, Cohesion and Competence in Oral Discourse through Intelligible Pronunciation.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures • Extempore	
	Assessment/ Examination Scheme:	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: ***Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication***

Verma, Shalini. Word Power made Handy, S. Chand Publications

High School English Grammar & Composition by Wren & Martin

References: ***K.K.Sinha, Business Communication, Galgotia Publishing Company.***

ENVIRONMENTAL STUDIES-I

Course Code: EVS – 142 | **Credit Units: 02**
Total Hours: 20

Course Objectives

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behavior and the growth, development and maturity of living organisms. At present a great number of environmental issues, have grown and complexity day by day, threatening the survival of mankind on earth. Environment study is quite essential in all streams of studies including environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

Course Contents:

Module I: The multidisciplinary nature of environmental studies (6 Hrs)

Definition, scope and importance

Need for public awareness

Module II: Natural Resources (8 Hrs)

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems (3 Hrs)

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation (3 Hrs)

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Course Outcome

Upon course completion, students will be able to understand:

- The multidisciplinary nature of environmental studies, including its definition, scope and need for public awareness.

- Our natural resources including renewable and non-renewable resources comprising of forest, water, mineral, food, energy and land resources.
- The ecosystem, their structure and function, energy flow, bio-geochemical cycles, community ecology, ecological succession, ecological pyramids, forest, grassland, aquatic and tundra ecosystem.
- Biodiversity and its conservation.
- Ecosystem diversity, species diversity and genetic diversity.
- Biological classification of India.
- Value of biodiversity.
- Biodiversity at global national and local level.
- Conservation of biodiversity.
- Characteristic of ideal ecosystem.
- Study of an artificial ecosystem.

Examination Scheme:

Components	**CT**	**HA**	**S/V/Q**	**A**	**ESE**
Weightage (%)	15	5	5	5	70

Text & References:

- Chauhan B. S. 2009: Environmental Studies, University Science Press New Delhi.
- Dhameja S.K., 2010; Environmental Studies, Katson Publisher, New Delhi.
- Smriti Srivastava, 2011: Energy Environment Ecology and Society, Katson Publisher, New Delhi.
- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioural Science - I

Course Code: BSU-143 **Course Credit: 01**

Course Objective:

This course aims at imparting an understanding of:

- Understanding self & process of self exploration
- Learning strategies for development of a healthy self esteem
- Importance of attitudes and its effective on personality
- Building Emotional Competency

Course Contents:

Module I: Self: Core Competency **(2 Hours)**

- Understanding of Self
- Components of Self – Self identity
- Self concept
- Self confidence
- Self image

Module II: Techniques of Self Awareness **(2 Hours)**

- Exploration through Johari Window
- Mapping the key characteristics of self
- Framing a charter for self
- Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness **(2 Hours)**

- Meaning
- Importance
- Components of self esteem
- High and low self esteem
- Measuring your self esteem

Module IV: Building Positive Attitude **(2 Hours)**

- Meaning and nature of attitude
- Components and Types of attitude
- Importance and relevance of attitude

Module V: Building Emotional Competence **(2 Hours)**

- Emotional Intelligence – Meaning, components, Importance and Relevance
- Positive and negative emotions
- Healthy and Unhealthy expression of emotions

Student learning outcomes

- Student will Develop accurate sense of self
- Student will nurture a deep understanding of personal motivation
- Student will develop thorough understanding of personal and professional responsibility
- Student will able to analyse the emotions of others for better adjustment.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-I

CourseCode: FLU144 **Creditunits: 02**

CourseObjective:
Tofamiliarize studentswiththeFrenchlanguage,withitsphonetic systemanditsaccents.
Toenable students

- togreet someone inFrench
- topresent anddescribe oneselfandpeople
- toenterincontact,andbegina conversation
- totalkaboutone'sfamily,tastes andpreferences

CourseContents:
Dossiers1,2–pg5-24Dossier1:Toi,moi,nousActesdeCommunication:
S'adresserpolimentàquelqu'un,entrerencontact,seprésenter,présenterquelqu'un,saluer,poserdesquestions
simplespourconnaître quelqu'un,épeleret compter
Dossier2:EnfamilleActesdeCommunication:
Parler de sa famille, Décrire quelqu'un, exprimer ses goûts, écrire et comprendre un message court, inviter
quelqu'un,exprimerla possession,la négation
Grammaire :
1. articles indéfinis,articlesdéfinis, masculinetfémininesdesnomset desadjectifs,pluriel desnomset desadjectifs
2. pronomssujetsettoniques,on,c'est/il est+ profession,
3.masculinet fémininesdesadjectifsdenationalité
4. verbes-être,avoir,aller,'er'groupe
5. l'interrogation–l'intonation,est-ce que,quiest-ce ? Qu'est-ce que? L'inversion; où,comment,quand; quel
6. la négation
7. adjectifspossessifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:
Text:
Le livre àsuivre:
· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.
Références:
· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

PLANT SCIENCES - II

Course Code: BSC 201 **Credit Units: 04**

Course Objective:

The objective of this course is to acquaint the students with the details of gymnosperms, classification of angiosperms and taxonomy which will make a foundation for further studies.

Learning Outcomes:

1. The students will develop an understanding of the characteristics, life cycles & interrelationships among different forms of gymnosperm.
2. The course content will help the students to trace the evolutionary history, diversity of gymnosperms & develop an understanding of fossils, fossilization & geological time scale and its significance in the evolution of angiosperms.
3. The students will develop an understanding of the basis, guiding principles & salient features of the various classification systems of angiosperms.
4. Know the economic importance of the angiosperm plants.
5. Systematic position, distinguishing characters and economic importance of some important families like Rutaceae, Cucurbitaceae,Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Course Contents:

GYMNOSPERMS

Module I

General characteristics, affinities and classification of Gymnospermsm (Chamberlains' and D.D Pant's classification), Evolution and diversity of Gymnosperms, Fossil Gymnosperms: *Lyginopteris* and *Lagenostoma.*

Module II

Systematic position, occurrence, morphology and development of reproductive structures of the following taxa- *Cycas, Pinus, Ephedra,* Economic importance of *Cycas, Pinus* and *Ephedra.*

TAXONOMY OF ANGIOSPERMS

Module III

Classification as proposed by Bentham and Hooker and Hutchinson, merits, demerits and comparison Binomial Nomenclature and elementary knowledge of International Code of Botanical nomenclature.

Module IV

Systematic position, distinguishing characters and economic importance of family: Rutaceae, Cucurbitaceae, Rosaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Euphorbiaceae, and Poaceae.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Modern Plant Taxonomy, N.S. Subrahmanyam, Vikas Publishing House.
- A Text Book of Botany, V. Singh, P.C. Pande& D.K. Jain, Rastogi Publication.

References:

- Plant Systematics Theory & Practice, Gurcharan Singh, Oxford & IBH Publishing Co.
- Taxonomy, V. Singh & D. K. Jain, Rastogi Publications.
- Botany for degree students – Gymnosperms, P.C. Vashishtha, S. Chand & Co.
- Gymnosperm, S. P. Bhatnagar & A. Moitra, New Age.
- College Botary Vol.2, B.P. Pandey, S. Chand & Co.
- Systematic Botany, S.C. Datta, New Age.
- Text Book of Botany Vol. II. S. N. Pandey, S. P Misra, P. S. Trivedi, Vikas Publishing House.
- Introductory Botany, A. Bendre& P. C. Pandey, Rastogi Publication.

ANIMAL SCIENCES-II

Course Code: BSC 202 **Credit Units: 04**

Objectives This paper will provide the conceptual knowledge about Vertebrates, which includes from Pisces to Mammals. This paper will be helpful to understand the variations from one class to another. The knowledge gained from this subject will be helpful for students to realise the significance of animal sciences towards its applications in modern biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Develop knowledge about Chordates.
- Learn about comparative account of vertebrates.
- Learn about anatomical & physiological variability among vertebrates.
- Generates interdisciplinary and collaborative approach.
- Develops ethical and conservative outlook for animals.

Course Contents:

Module I: Salient features and outline classification of Phylum Chordata upto order with suitable examples (According to Parker and Haswell latest edition)

Module II:

- Urochordata: Type Study of *Herdmania* (Including development)
- Cephalochordata: Type Study of *Amphioxus*. Affinities of *Amphioxus*
- *Petromyzon*: External Features
- Comparison between *Petromyzon* and *Myxine*

Module II: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Integumentary system
- Skeletal System: Girdles only
- Digestive system

Module IV: Comparative anatomy of vertebrates (Fish, Amphibia, Reptiles, Birds and Mammals)

- Respiratory System
- Circulatory System: Heart and Aortic Arches only
- Nervous System; Brain only
- Urinogenital System

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - II

Course Code: BSC 203 **Credit Units: 05**

Course Objective:

The students will acquire knowledge about the compounds of carbon mainly hydrocarbon. They will be acquainted with the methods of qualitative and quantitative analysis of elements of hydrocarbons and methods of preparation of these compounds. They will get knowledge about the behavior of chemical and physical reactions along with electrolysis process.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic Stereochemistry, Structure, Bonding mechanism & Molar mass so that application of materials in different field can be understood.
- To learn & understand the Quantitative & Qualitative analysis of Elements Estimation
- To understand the Nomenclature of various Organic Compounds
- To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale
- To understand the behavior and synthesis of various hydrocarbons and its end use & production in industrial scale
- To learn and understand chemical equilibrium and electrochemistry for various applications

Course Contents:

ORGANIC CHEMISTRY

Module I

Organic chemistry as chemistry of carbon compounds, Methods of purification, tests of purity: qualitative and quantitative elemental analysis, determination of molecular masses: calculation of Empirical and Molecular formula, Structural formula. Tetrahedral concept of carbon compounds; nomenclature of organic compounds; Isomerism; stereo-isomerism, geometrical and optical isomerism.

Module II

Petroleum: Fractionation, cracking and synthetic petrol.

General methods of preparation and properties of alkanes, alkenes, alkynes, Halogen substituted alkanes (CH_2CI_2 , $CHCI_3$, CCI_4, CHI_3), Electrophilic substitutions. General study of Cycloalkanes

Module III

Grignard reagent; preparation and uses,
Alcohol; ethanol, propanol, glycerol
Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic,
General methods of preparation of aliphatic aldehydes and ketones,
Keto-enol tautomerism; aceto-acetic ester and malonic ester.

PHYSICAL CHEMISTRY

Module IV

Chemical equilibrium: Reversible reactions, equilibrium law, equilibrium constant, factors influencing equilibrium states.

Module V

Eletrochemistry: Electrolysis, laws of electrolysis, ionisation constant, specific, equivalent and molecular conductance, common ion effect; Hydrogen ion concentration, pH value, Theory of acid base indicators, buffer solutions, hydrolysis of salts and solubility product simple calculations based on these concepts.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I& II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India.

PLANT SCIENCES LAB - II

Course Code: BSC 220 **Credit Units: 02**

Course Contents:

Module I: Gymnosperm

Study of the Gymnosperms like *Cycas, Pinus* and *Ephedra* with the help of permanent slides and also by cutting sections and making suitable preparations.

Module II: Taxonomy

Detailed description and identification of locally available plants of the families as prescribed in theory course.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL SCIENCES LAB - II

Course Code: BSC 221 **Credit Units: 02**

Course objective: Course objective is o provide the knowledge about plant science that should be useful to understand and apply different concepts about the diversity and complexity of animals.

Course Contents:

Module I: Study of different types of scales in fishes, permanent slide preparations of scales. Internal ear Different types of important edible fishes of India .Study of specimens and slides related to Chordates should be added

Module II: Study of *Rana tigrina*, physiological systems through model

Module III: Hyoid apparatus of home lizard, Demonstration of biting mechanism by using model

Module IV: Mice: Arterial system and reproductive system.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB – II

Course Code: BSC 222 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I
Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances) out of the following**:**
Pb^{2+}, Hg^{2+}, Hg $^{2+}$, Ag^{1+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sn^{4+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH $^{1+}$, K^{1+}, CO $^{2-}$, S^{2-}, SO $^{2-}$, NO $^{1-}$, CH COO^{1-}, F^{1-}, Cl^{1-}, Br^{1-}, I^{1-}, NO $^{1-}$, SO $^{2-}$, C O $^{2-}$, PO $^{3-}$, BO $^{3-}$.

Module II
Purification of Organic compounds by crystallization (from water or alcohol) and distillation.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-II

Course Code: **BCU 241** **Credit Units: 1**

Course Objectives:

To understand the different aspects of communication using the four macro skills – LSRW (Listening, Speaking, Reading, Writing)

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Communication**	**35% Weightage**
	• Process and Importance • Models of Communication (Linear & Shannon Weaver) • Role and Purpose • Types & Channels • Communication Networks • Principles & Barriers	
2.	**Module II Verbal Communication**	**25% Weightage**
	Oral Communication: Forms, Advantages & Disadvantages Written Communication: Forms, Advantages & Disadvantages Introduction of Communication Skills (Listening, Speaking, Reading, Writing)	
3.	**Module III Non-Verbal Communication**	**30% Weightage**
	• Principles & Significance of Nonverbal Communication • KOPPACT (Kinesics, Oculesics, Proxemics, Para-Language, Artifacts, Chronemics, Tactilics) • Visible Code	
4.	**Module IV : Prose**	**10% Weightage**
	TEXT: APJ Abdul Kalam and Arun Tiwari. *Wings of Fire: An Autobiography*, Universities Press, 2011 Comprehension Questions will be set in the End-Semester Exam	
5.	**Student Learning Outcomes:** The students should be able to : • Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment	
6.	**Pedagogy for Course Delivery:** • Extempore • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**
100%	NA

Theory Assessment (L&T):

Components (Drop down)	CIE	Mid Sem	Attendance	**End Term Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rosenblum, M. How to Build Better Vocabulary, London: Bloomsbury Publication.*
Verma, Shalini. Word Power made Handy, S. Chand Publications.
High School English Grammar & Composition by Wren & Martin.

Reference: *K.K.Sinha , Business Communication, Galgotia Publishing Company.*
Alan Pease : Body Language

Additional Reading: Newspapers and Journals

ENVIRONMENTAL STUDIES-II

Course Code: EVS– 242 **Credit Units: 02**
Total Hours: 20

Course Objectives

- To understand various types of environmental pollution.
- To educate masses, in general and students, about the issues related to degradation of environment and social issues related to environment.
- To understand sustainable development.
- To understand environmental assets, local flora and fauna through field surveys.

Course Contents:

Module I: Environmental Pollution (7 Hrs)

Definition, causes, effects and control measures of:Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module II: Social Issues and the Environment (7 Hrs)

From unsustainable to sustainable development, Urban problems and related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns Case studies.Environmental ethics: Issues and possible solutions

Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear Accidents and Holocaust case studies. Fireworks/Crackers – Introduction, ill effects on environment and humans.

Wasteland reclamation, Consumerism and waste products, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. issues involved in enforcement of environmental legislation Public awareness

Module III: Human Population and the Environment (4 Hrs)

Population growth, variation among nations. Population explosion – Family Welfare Programmes

Environment and human health. Human Rights. Value Education. HIV / AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human Health.

Case Studies

Module IV: Field Work (2 Hrs)

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc.

Course Outcome

Upon course completion, students will be able to:

- Explain various types of environmental pollutions.
- Understand role of individual in abatement of environmental pollution.
- Explain methods to mitigate disasters.
- Learn various environmental protection laws.
- Learn role of IT in environment and human health.

Examination Scheme:

Components	CT	HA	S/V/Q	A	ESE
Weightage (%)	15	5	5	5	70

Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay (R) Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p. McKinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB) Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Behavioral Science - II

Course Code: BSU-243 **Course Credit: 01**
Total Hours: 10

Course Objective:

This course aims at enabling students towards:

- Understand the importance of individual differences
- Better understanding of self in relation to society and nation
- Facilitation for a meaningful existence and adjustment in society
- Inculcating patriotism and national pride

Course Contents:

Module I: Individual differences & Personality **(2 Hours)**

- Personality: Definition& Relevance
- Importance of nature & nurture in Personality Development
- Importance and Recognition of Individual differences in Personality
- Accepting and Managing Individual differences
- Intuition, Judgment, Perception & Sensation (MBTI)
- BIG5 Factors

Module II: Managing Diversity

- Defining Diversity
- Affirmation Action and Managing Diversity **(2 Hours)**
- Increasing Diversity in Work Force
- Barriers and Challenges in Managing Diversity

Module III: Socialization **(2 Hours)**

- Nature of Socialization
- Social Interaction
- Interaction of Socialization Process
- Contributions to Society and Nation

Module IV: Patriotism and National Pride **(2 Hours)**

- Sense of pride and patriotism
- Importance of discipline and hard work
- Integrity and accountability

Module V: Human Rights, Values and Ethics **(2 Hours)**

- Meaning and Importance of human rights
- Human rights awareness
- Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

Student learning outcomes

▪Student will be able to identify, understand, and apply contemporary theories of leadership to a wide range of situations and interactions

▪Student will be able to understand and respect individual difference, so to enhance the relationship ▪Learn social responsibility and develop a sense of citizenship

▪Student will be able to identify and understand the impact of culture on one's leadership style

Examination Scheme:

Evaluation Components	Atten dance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Davis, K. Organizational Behaviour,
- Bates, A. P. and Julian, J.: Sociology - Understanding SocialBehaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
.•Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985. Robbins O.B.Stephen;.
Organizational Behaviou

Français-II

CourseCode: FLU244 **Creditunits: 02**

CourseObjective:

Tofurnishthelinguistictools

- totalkaboutdailyactivitiesand sports,toexpressnecessities
- totalkaboutactivitiesinrecent future,
- tohave conversationsandperform daytodaylife taskslike enquiringabouttime,take anappointment
- toenquire aboutproductsandplace orders ina shop/ restaurant.

CourseContents:

Dossiers3,4–pg25-44 Dossier3:Quelle journée! ActesdeCommunication:

Parlerdesesactivitésquotidiennes,sesituerdansletemps,demanderl'heureetladate,parlerdessportsetdes loisirs,exprimerla fréquence

Dossier4:Vousdésirez?ActeeCommunication:

Exprimerlaquantité,demanderetdonnerleprix,exprimerlanécessité,lavolontéetlacapacité,compareret exprimersespréférences, s'exprimer au futur proche, prendrerendez-vous, s'exprimer aurestaurant/dansles magasins

Grammaire :

1. l'expressiondutemps
2. lesarticlescontractés,lesquantités indéterminéeset déterminées
3. lesadverbesde fréquences
4. verbes-faire,prendre,venir,pouvoir,vouloir,lesverbespronominaux
5. lacomparaisondel'adjectif
6. la négation(suite)
7. lefutureproche

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

- Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.
- Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

- Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010.

ANATOMY & PLANT PHYSIOLOGY

Course Code: BSC 301 **Credit Units: 04**

Course Objective:

The objective of this course is to familiarize the students with mechanisms of various physiological activities of higher plants, anatomy and ecology which will help them to understand the various profiles of biotechnology and assessment of environment.

Learning Outcomes:

1. The students will be conceptually integrated to plant internal structure & their functions
2. Will further reveal the relationship between the structure, function, taxonomy, ecology and developmental genetics in plants.
3. The contents of this course will help the students to relate crop physiological processes with water-plant interaction, mineral absorption, transportation & assimilation.
4. The concept of photosynthesis in plant, the role & significance of pigment system in photosynthesis, components of light and dark reaction, C3 & C4 pathways for carbon fixation & the influence of environmental factors on photosynthesis will be understood by the students.
5. The students will acquire an understanding of the concept of respiration: mechanisms, factors & its importance.

Course Contents:

Module I

Meristems. Epidermis, Stoma, Leaf anatomy, origin, structure and function of the Vascular cambium including anomalous behaviourof cambium in *Achyranthes*, *Boerhaavia*, *Bignonia* and *Dracaena*. Structure of Xylem and Phloem. Cork cambium activity and products. Root-stem transition.

Module II

Diffusion, osmosis, permeability, imbibition, plasmolysis, osmotic potential and water potential. Absorption of water: Passive and active absorption. Ascent of sap. Transpiration, closing and opening mechanism of stomata, significance of transpiration, guttation, factors affecting transpiration.

Module III

Mechanism of absorption of mineral salts. Elementary knowledge of the macro- and micro- elements. Symptoms of mineral deficiency, Hydroponics and sand cultures. Mechanism of translocation of solutes.

Module IV

Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system, C_3 and C_4 pathway and factors affecting photosynthesis, Respiration: Glycolysis, Krebs cycle, factors affecting respiration.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Text Book of Plant Physiology, C. P. Malik & A. K. Srivastava, Kalyani Publishers.
- Anatomy of Seed Plants, V. Singh, P. C. Pande, D. K. Jain, Rastogi Publications.

References:

- Anatomy of Seed Plants, K. Esau, John Wiley & Sons.
- An introduction to Plant Anatomy, A. J. Eames and A. H. Mac Daniels, Tata McGraw - Hill.
- Plant Physiology, S. N. Pandey, B. K. Sinha, Vikas Publishing House.
- Plant Physiology, R. M. Devlin and F. H. Witham, CBS Publishers.
- Plant Physiology, S. Mukherji and A. K. Ghosh, Tata McGraw - Hill.
- Plant Physiology and Biochemistry, Prof. H. Srivastava, Rastogi Publications.
- Plant Anatomy A. Fahn, Aditya Books Pvt. Lmt.

ANIMAL PHYSIOLOGY - I

Course Code: BSC 302 **Credit Units: 04**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Gain knowledge about functioning of systems of body.
- Generate path for further research and innovation.
- Enhance new collaborative approaches with modern fields of biotechnology.

Course Contents:

Module I: Physiology of Respiratory System: Organs for respiration in mammals, Mechanism of respiration, Physiology of respiration (transport of gases and chloride shift), Properties and function of respiratory pigments.

Module II: Physiology of Digestive System Composition and function of saliva, Mechanical and chemical digestion, Functions of pancreatic juices and biles, Absorption and distribution of food

Module III: Physiology of Cardiovascular System Blood composition and Hemopoisis, Blood Groups and Blood Transfusion, Blood Clotting, Hemodynamics, Cardiac Cycle and its regulation,

Module IV: Physiology of Neuromuscular System Contraction and relaxation of muscle, Sarcomere, Cori‟s cycle, Organization of Nervous System, Neuron, Nerve Impulse, Synaptic Transmission, Neurotransmitters.

Examination Scheme:

Components	**CT**	**Attendance**	**Assignment/ Project/Seminar/Quiz**	**EE**
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
- Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston.
- T. C. Majpuria. A text book of zoology.
- V.K Tiwari, A Text book of Zoology
- Ramesh Gupta, A Text book of Zoology

CHEMISTRY - III

Course Code: BSC 303 **Credit Units: 05**

Course Objective:

The students will learn about the various laws and conditions which govern the behaviour of liquid and solution and the phases in which they exist under different conditions.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic Structure, Bonding mechanism and application of materials in different field
- To learn & understand the acid and basic concept
- To understand the concepts of Coordination Chemistry
- To understand the synthesis, properties and application of various inorganic acids in various field
- To understand Phase Equilibria law and its application in various field like purification, precipitation, and understanding temperature behavior, and various states of any system

Course Contents:

INORGANIC CHEMISTRY

Module I

Acid and Bases: Elementary idea of Bronsted -Lowry and Lewis concept of acids and bases (Proton-donor acceptor and electrondonor acceptor systems), Relative strengths of Lewis acids bases and the effect of subsistent and the solvent on them.

Module II

General properties of 3rd elements & Co-ordination Compounds: Molecular compounds, Werners coordination theory, IUPAC system of nomenclature of coordination compounds. Discussion of outer and inner orbit complexes.

Module III

Preparation, properties, uses and structure of the following compounds -Tin Chlorides, hydrazine, hydroxylamine and acides, Oxides, Oxyacids and halides of phosphorus, tartaremetic, hydrogen sulphide (analytical applications), Oxides and Oxyacids of sulphur, Oxyacids of chlorine.

PHYSICAL CHEMISTRY

Module IV

Liquids:Vapor pressure, variation of vapour pressure of liquids with temperature (Clausious – Claperon Equation). Surface tension, viscosity, their experimental determination and applications. Parachor, Rheochor and their applications.

Module V

Solutions: Henery's Law, Raoult's Law, critical solutions temperatures, fractional distillation and steam distillation. Osmosis and measurement of osmotic pressure. Effect of solutes on boiling points and freezing points of solutions, Calculations of molecular weights, abnormal molecular weight.

Module VI

Heterogenous equilibria: Phase rule, phase diagrams of water and sulphur system. Nernst'sdistribution law, solvent extraction.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S.Chand & Co. Ltd.
- Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Concise Inorganic Chemistry, J.D. Lee, BlackWell Sciences
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
- Atkin's Physical Chemistry, Atkin, Oxford Press.
- Physical Chemistry, Vemulapalli, Printice Hall of India

ANATOMY & PLANT PHYSIOLOGY LAB

Course Code: BSC 320 **Credit Units: 02**

Module I: Physiology
Water, Soil, and Plant relations Demonstration: Permanent and Temporary wilting, seeding growth in clay.
Experimentation- determination: iso-hypo-and-hyper tonic solution by plasmolytic methods, stomatal frequency by cobalt chloride method, Farmer's Potometer.
Photosynthesis: Demonstration- CO_2 factor, light factors (red, blue, green and yellow light.)
Experimentation- Separations of photosynthetic pigments by thin layer chromatography.
Respiration – Determination of R.Q.
Module II: Plant Anatomy
Anatomy of normal dicot and monocot roots, stems & leaves
Anatomy of anomalous structure of stems of Bignonia, Nyctanthes, Achryanthes, Boerhaavia and Dracaena.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

Animal Physiology LAB - I

Course Code: BSC 321 **Credit Units: 02**

- Study of permanent slides: Study of Respiratory system, Digestive system, Cardiovascular System and Neuromuscular System.
- Determination of RBC count in blood sample.
- Determination of Hb % using Sahl's Hemoglobinometer.
- Blood Group Testing (ABO & Rh)
- Determination of TLC & DLC in blood sample.
- Demonstrate amylase activity from saliva.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - III

Course Code: BSC 322 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I

Gravimetric estimation of barium and SO $^{2+}$ as BaSo ions, iron as F O and copper as CuCNS.

ORGANIC CHEMISTRY

Module II

Detection of functional groups in mono-functional Organic Compounds. (aldehyde, ester, phenol, amine, amides, alcohols.)

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-III

Course Code: BCU 341 **Credit Units: 1**

Course Objective:

To emphasize the essential aspects of effective written communication necessary for professional success.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Principles of Effective Writing** • Spellings-100 Most Misspelled Words in English • Web Based Writing • Note Taking: Process & Techniques	**35%Weightage**
2.	**Module II Formal Letter Writing** • Block Format • Types of Letters • E-mail • Netiquette	**35% Weightage**
3.	**Module III Business Memos** • Format & Characteristics	**20% Weightage**
4.	**Module IV Short Stories** • Stench of Kerosene-Amrita Pritam • A Flowering Tree-A.K. Ramanujan • The Gift of the Magi- O. Henry • A Fly in Buttermilk-James Baldwin	**10%Weightage**
5.	**Student Learning Outcomes:** The students should be able to write correctly and properly with special reference to Letter writing.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**EndTerm Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	ClE	Mid Sem	Attendance	**EndTerm Examination**
Weightage (%)	10%	15%	5%	70%

Text: *Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.*

K.K.Sinha, Business Communication, Galgotia Publishing Company.

Reference: *Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press.*

Additional Reading: Newspapers and Journals

Behavioural Science – III

Course Code: BSU-343 **Course Credit: 01**

Course Objective:
To enable the students:
- Understand the process of problem solving and creative thinking.
- Facilitation and enhancement of skills required for decision-making.

Course Contents:
Module I: Thinking as a tool for Problem Solving (2 Hours)
- What is thinking: The Mind/Brain/Behavior
- Critical Thinking and Learning:
- Making Predictions and Reasoning
- Memory and Critical Thinking
- Emotions and Critical Thinking
- Thinking skills

Module II: Hindrances to Problem Solving Process (2 Hours)
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module III: Problem Solving (2 Hours)
- Recognizing and Defining a problem
- Analyzing the problem (potential causes)
- Developing possible alternatives
- Evaluating Solutions
- Resolution of problem
- Implementation
- Barriers to problem solving:
- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action (2 Hour)
- Construction of POA
- Monitoring
- Reviewing and analyzing the outcome

Module V: Creative Thinking (2 Hours)
- Definition and meaning of creativity
- The nature of creative thinking
- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating
- The six-phase model of Creative Thinking: ICEDIP model

Student learning outcomes
- Student will be able to understand and solve the problems effectively in their personal and professional life.
- Students will outline multiple divergent solutions to a problem,
- Student will able to create and explore risky or controversial ideas, and synthesize ideas/expertise to generate innovations.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999 •Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
- Richard Y. Chang and P. Keith, Kelly: Wheeler Publishing, New Delhi, 1998. •Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management (1996); Pfeiffer & Company
- Bensley, Alan D.: Critical Thinking in Psychology – A Unified Skills Approach, (1998), Brooks/Cole Publishing Company.

Français-III

CourseCode:FLU344 **Credit units:02**

Course Objective:

Toenablethe students

- totalkaboutthe qualitiesanddefectsofpeople.
- toask/give directions,toenquireabouta lodging.
- toaskandgive informationsaboutacertainplace.
- todescribe events inpast tense.

CourseContents:

Dossiers5,6–pg45-64Dossier5:Ici etlàActesdeCommunication:

Exprimer l'obligationetl'interdiction,parler desqualitésetdesdéfautsdequelqu'un,demander son chemin,
indiquerunitinéraire,se situerdansl'espace,serenseignersurunlogement.

Dossier6:AilleursActesdeCommunication:

S'exprimeraupassécomposé,raconterunvoyage,
sesituerdanslemonde,exprimerletemps(avecindicateursde
temps–ilya,depuis),serenseignersurunhébergement,exprimerla satisfactionet l'insatisfaction.

Grammaire :

1. lesadjectifsdémonstratifs
2. lesverbes:'irgroupe'devoir,falloir
3. lesprépositionsdelieu,depays
4. l'impératif,lepassé composé,forme et accordduparticipe passé,lanégationaupassécomposé
5. les indicateursdetemps(il ya,depuis)

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.

TERM PAPER

Course Code: BSC 330 **Credit Units: 02**

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a) The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b) Begin by making a list of subject-headings under which you might expect the subject to be listed.
c) The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a) Get facts, not just opinions. Compare the facts with author's conclusion.
b) In research studies, notice the methods and procedures, results & conclusions.
c) Check cross references.

4. Outlining the paper

a) Review notes to find main sub-divisions of the subject.
b) Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

a) statement of purpose
b) main body of the paper
c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c) Check for proper spelling, phrasing and sentence construction.
d) Check for proper form on footnotes, quotes, and punctuation.
e) Check to see that quotations serve one of the following purposes:
   (i) Show evidence of what an author has said.
   (ii) Avoid misrepresentation through restatement.
   (iii) Save unnecessary writing when ideas have been well expressed by the original author.

f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Structure

It should be composed of the following sections:

1) Title page
2) Acknowledgement
3) Abstract
4) Table of contents
5) Introduction: This includes overview of topic or what is the issue or problem? What is the significance of the problem or topic?
6) Literature Review/Background: What is previous/current thinking, findings, and approaches on the topic/problem?
7) Methodology/Discussion: Explanation of topic, any comparison/observation/study. How did you search for information or data on the topic? What is your impression of the utility, relevance, or quality of the data you collected?
8) Results (If any)
9) Conclusion: Summarize the most important findings. It can include summary of main limitations of the study at hand. What conclusions can you draw? Also include details of possibilities for related future research
10) References/Bibliography: From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

c) File Specifications: The file should be submitted in plastic folder with following specifications:

i. A4 size paper
ii. Font: Arial(10 pts) or Times New Roman(12pts)
iii. Line Spacing(1.5)
iv. Top & Bottom Margins 1 inch/2.5 cm
v. Left & Right Margins 1.25 inch/3 cm

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

[1] Pandian, P.S. ,Safeer, K.P., Shakunthala, D.T. ,Gopal, P, Padaki, V.C.” Internet Protocol Based Store and Forward Wireless Telemedicine System for VSAT and Wireless Local Area Network” IEEE - ICSCN 2007, MIT Campus, Anna University, Chennai, India. Feb. 22-24, 2007. pp.54-58.

[2] Shazia Karim, Imran Sarwar Bajwa,”Clinical Decision Support System based Virtual Telemedicine”2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics [3]Carlos Dafonte, Angel Gomez , Bernardino Arca, and Jose A. Taboada “Intelligent Management of Processes in a ICU Telemedicine System” Proceedings of the 22nd Annual EMBS International Conference, July 23-28,2000, Chicago IL.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY

Course Code: BSC 401 **Credit Units: 04**

Course Objective:

To familiarize the students, with basics of Plant embryology and pathology with details of phyto diseases. They will also be acquainted with economic importance of Timber, food, fiber and medicinal plants, current trends in Plant breeding programmes will also be explained. These studies will support them for understanding the various aspects of biotechnology.

Learning Outcomes:

1. The students will develop modern approach to experimental plant embryology from developmental, structural and molecular point of view.
2. The course will provide in depth information on developmental cycles, regulation of the flowering process, of micro- and macrosporogenesis, on self-incompatibility & on embryo formation.
3. The students will be able to analyse the historical evolution of plant breeding. Will be able to understand the basic Mendelian genetics, plant reproduction systems and breeding products.
4. The students will develop an understanding of the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time. With knowledge of these factors they will begin to understand the nature of plant disease epidemics and how to manage them.
5. The students will develop an understanding of the vast economic importance of angiosperms with reference to their use as source of food, fuel, fibers & medicine.

Course Contents:

Module I

Structure of anther, microsporogenesis and development of the male gametophyte. Structure of Ovule, megasporogenesis and development of the female gametophyte with particular reference to *Polygonum* type. Fertilisation, Endosperm and embryo onagrad type.

Module II

Nature and objectives of plant breeding. General methods of plant breeding. Role of Hybrid vigour in plant breeding

Module III

General symptoms of fungal, bacterial and viral diseases and their control. Systematic position, morphology of the causal organisms, parasite relationship, disease cycles in the following diseases, Loose smut of wheat, Rust of wheat, Citrus canker and yellow vein disease of Bhindi.

Module IV

Economic importance with special reference to plants yielding:

a) Food: Cereals (Wheat, Maize) , Sugarcane, Legumes – (Pigeon pea,), Oil yielding plants (sarson),
b) Common fibre yielding plants - Cotton, Jute .
c) Medicinal Plants – (*Papaver somniferum, and Atropabeladona.)*
d) Common timber yielding plants –*Dalbergiasisso, Tectonagrandis.*

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

- Angiosperms, S.S. Bhojwani, S.P. Bhatnagar, Vikas Publishing House Pvt. Ltd.
- Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishing C. Pvt. Ltd.
- Economic Botany in the Tropics, S.L. Kochhar, Macmilian
- Plant Pathology – Pathogen and Plant Disease, B.P. Pandey, S.Chand& Company Ltd.
- Ecology & Environment, P.D. Sharma, Rastogi Publications.

References:

- Plant Anatomy and Embryology, S.N. Pandey, A. Chadha, Vikas Publishing House Pvt. Ltd.
- Embryology of Angiosperm, Singh, Pandey and Jain, Rastogi Publication
- Introduction to Embryology of Angiosperm, A.K. Pandey, CBS Publishers and Distributors
- Principles and Practice of Plant Breeding, J.R. Sharma, Tata McGraw Hill Publishing Company Limited
- Economic Botany of Crop Plants, A.V.S.S. Sambamurty, N.S. Subramanyam, Asiatech Publishers
- Plant Breeding: Theory & Techniques, S.K. Gupta, Agrobios (India)

ANIMAL PHYSIOLOGY- II

Course Code: BSC 402 **Credit Units: 04**

Course Objective: Course objective to provide the knowledge about animal physiology that should be useful to understand and apply different concepts of biotechnology.

Learning Outcomes:

After successful completion of the course student will be able to:

- Learn about anatomical and physiological aspects of animal body.
- Understands functioning of important systems of body.
- Develops knowledge about endocrinology and developmental biology.
- Leads to enhance interest in research in advanced biotechnology.
- Exposure with other interdisciplinary subjects of biology.

Course Contents:

Module 1: Endocrine Physiology: Endocrine glands in mammals

- General anatomy and physiology Pituitary,
- General anatomy and physiology of Thyroid,
- General anatomy and physiology Parathyroid,
- General anatomy and physiology Pancreatic islets
- General anatomy and physiology Adrenal

Module II: Excretory System:

- General morphology and characteristics of Mammalian Kidney (Rabbit).
- Structure & Function of Tubular reabsorption and Secretion.
- Structure & Function of Nephron, Glomerular filtration.

Module III:Reproductive System:

- Structure & Function of Testes & Ovary of Rabbit.
- Spermatogenesis and its hormonal regulation
- Oogenesis and its hormonal Regulation
- Ovulation and fertilization

Module IV:Developmental Biology:

- Gametogenesis, structure of sperm and ovum, Egg types, Egg membrane
- Cleavage: types.
- Formation of blastula in chick
- Fate Map, Morphogenetic Movement & Gastrulation in Chick.
- Extra embryonic membranes in chick

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

- Guyton, A.C. and Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
- Tortora, G.J. and Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons, Inc.
- Ganong, H, Review of Medial Physiology 14th edition, Appleton &Lange Publisher, New York
Shier, D., Butler, J. and Lewis, R., Hole‟s Human Anatomy and Physiology, (10th Edition) 2003. WCB/McGraw Hill, Boston
  - T. C. Majpuria. A text book of zoology.
  - V.K Tiwari, A Text book of Zoology
  - Ramesh Gupta, A Text book of Zoology

CHEMISTRY - IV

Course Code: BSC 403 **Credit Units: 05**

Course Objective:

The objective of this course is to educate the students about the laws of thermodynamics and its applications, tendency of carbon element to form aromatic &non aromatic compounds and their uses.

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic structure, bonding, reaction mechanism and application of various organic compounds like carbohydrates, aromatic compounds, aromatic hydrocarbons
- To understand Chemical Thermodynamics, Electrochemistry & Photochemistry concepts

Course Contents:

ORGANIC CHEMISTRY

Module I: Carbohydrates

Classification of carbohydrates, constitution of glucose and fructose, mutarotation, General reactions of monosaccharide. An overview of disaccharides

Module II

General study of aromatic compounds, orientation of aromatic compounds, aromaticity.
Study of preparation and properties of Toluene, Halogen substituted aromatic compounds; Chlorobenzene, benzene diazonium chloride, Phenols, nitrobenzene, aniline.

Module III

General study of aromatic aldehydes and ketones, phenolic aldehydes & ketones, Aromatic carboxylic acids, phthalic acid and salicylic acid.
Benzene sulphonic acid, sulphanilic acid

Module IV

Poly aromatic hydrocarbons; preparation and synthesis of Naphalene, alpha and beta napthol. Constitution of heterocyclic compounds for example pyridine and quinolene.

PHYSICAL CHEMICAL

ModuleV: Chemical Thermodynamics

Energy, Work, Heat capacity. The first law of Thermodynamics, Heat of a reaction at constant pressure and constant volume. Hess's law, Kirchoff's Equations. The Second Law of Thermodynamics. Entropy (S). Determination of Entropy. Changes for reversible transition processes. Free Energy (G), Free Energy Change and chemical equilibrium.

Module VI: Electrochemistry

Galvanic cells, standard electrode potential, types of electrodes, measurement of pH.

Module VII: Photochemistry

Lambert-Beer's Law: Law of photochemical equivalence; quantum efficiency, High and low quantum yields, reasons for high and low quantum yields, photoelectric cell. Phosphorescence and fluorescence.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- A text book of Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Principles of Physical Chemistry, Puri, Sharma &Pathania, Vishal Publishing Co.

References:

- Advanced Organic Chemistry, Bahl&Bahl, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I & II, I.L. Finar
- Fundamentals of Organic Chemistry, Nafis Haider, S. Chand & Co. Ltd.
- Organic Chemistry Vol.I, II & III, Dr. Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan.
- Essentials of Physical Chemistry, Bahl& Tuli, S. Chand & Co. Ltd.
- Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.

PLANT BREEDING, EMBRYOLOGY, PATHOLOGY & ECONOMIC BOTANY Lab

Course Code: BSC 420 **Credit Units: 02**

Course Contents:

Module I: Embryology

Study of permanent slides of the**:**

a) T.S. anther, pollen, germinating pollen
b) L.S. ovule types
c) Endosperm
d) Embryos
e) L.S. caryopsis
f) Dissection of embryo

Module II:Plant Pathology

Examination of local diseased plants representing bacterial, viral, fungal parasites. Study of symptoms caused by parasites, study of selected diseased specimen (mentioned under theory) through specimens, temporary presentations.

Module III: Economic Botany

Identification and comment on the plants and plant products belonging to cereals, pulses, sugarcane, fibre plants, timbers and medicinal plants

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

ANIMAL PHYSIOLOGY LAB - II

Course Code: BSC 421 **Credit Units: 02**

- Study of permanent slides: **Endocrinae system**
  - T.S of Pituitary gland
  - T.S of Thyroid gland
  - T.S of Parathyroid gland
  - T.S of Pancreatic islets
  - T.S of Adrenal gland

- Study of permanent slides: **Excretory System**
  - T.S of Kidney
  - T.S of Nephron
  - Estimation of Blood Urea, Bilirubin and Creatinine.

- Study of permanent slides: **Reproductive System**
  - T.S of Ovary
  - T.S of Testes
- Chick Embryology:
  - Permanent slide of different steps of development of Chick embryo.
  - Preparation of temporary slide of Chick embryo.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

.

CHEMISTRY LAB - IV

Course Code: BSC 422 **Credit Units: 02**

Course Contents:

ORGANIC CHEMISTRY

Module I
Synthesis of Organic Compounds
(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone.
Benzoylation of aniline and phenol.
(b) Aliphatic electrophilic substitution.
Preparation of iodoform from ethanol and acetone.
(C) Aromatic electrophilic substitution

Nitration
Preparation of m-dinitrobenzene
Preparation of p-nitro acetanilide
Halogenation
Preparation of p-Bromo acetanilide
Preparation of 2,4,6-tribromophenol.
(d) Diazotization/coupling
Preparation of methyl orange and methyl red
(e) Oxidation
Preparation of benzoic acid from toluene
(f) Reduction
Preparation of aniline from nitrobenzene
Preparation of aniline from nitrobenzene
Preparation of m-nitroaniline from m-dinitrobenzene

Module II

Stereochemical Study of Organic Compounds via Models
R and S configuration of optical isomers.
E and Z configuration of geometrical isomers.
Conformational analysis of cyclohexane's and substituted cyclohexane's.

Examination Scheme:

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL –IV

Course Code: BCU 441 **Credit Units: 1**

Course Objective:

This course is designed to develop the skills of the students in preparing job search artifacts and negotiating their use in GDs and interviews.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Employment-Related Correspondence**	**35% Weightage**
	• Resume Writing • Covering Letters • Follow Up Letters	
2.	**Module II Dynamics of Group Discussion**	**35% Weightage**
	• Significance of GD • Methodology & Guidelines	
3.	**Module III Interviews** • Types & Styles of Interviews • Fundamentals of facing Interviews • Interview-Frequently Asked Questions	**20% Weightage**
4.	**Module IV Short Stories**	**10% Weightage**
	• Proof of the Pudding - O. Henry • "The Lottery" 1948 – Shirley Jackson • The Eyes Have it- Ruskin Bond • Kallu- Ismat Chughtai All the four stories will be discussed in one class. One Long Question will be set in the Exam from the Text.	
5.	**Student Learning Outcomes:** • Develop a resume for oneself • Ability to handle the interview process confidently • Learn the subtle nuances of an effective group discussion	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	End Term Examination
Weightage (%)	25%	5%	70%

Text: *Sharma, R.C. & Krishna Mohan. Business Correspondence and Report Writing: A Practical approach to Business & Technical Communication, New Delhi: Tata McGraw Hill & Co. Ltd., 2002.*
Rai, Urmila & S.M. Rai. Business Communication, Mumbai: Himalaya Publishing House, 2002.

Rizvi, M.Ashraf. Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.

Reference: *Brusaw, Charles T., Gerald J. Alred & Walter E. Oliu. The Business Writer's Companion, Bedford: St. Martin's Press, 2010.*
Lewis, Norman. How to Read Better and Faster. New Delhi: Binny Publishing House.

Additional Reading: Newspapers and Journals.

Behavioural Science - IV

Course Code: BSU-443 **Course Credit: 01**
Total Hours: 10

Course Objective:
This course aims at imparting an understanding of Values, Ethics & Morality among students for making a balanced choice between personal & professional development.

Course Contents:

Module I: Introduction to Values & Ethics **(2 Hours)**
Meaning & its type
Relationship between Values and Ethics Its implication in one's life

Module II: Values Clarification & Acceptance **(2Hours)**
Core Values-Respect, Responsibility, Integrity, Resilience, Care, & Harmony Its process-Self Exploration
Nurturing Good values

Module III: Morality **(2 Hours)**
Difference between morality, ethics &values Significance of moral values

Module IV: Ethical Practice **(2 Hours)**
Ethical Decision making
Challenges in its implementation
Prevention of Corruption &Crime

Module V: Personal & Professional Values **(2 Hours)**
Personal values-Empathy, honesty, courage, commitment Professional Values-Work ethics, respect for others
Its role in personality development Character building-"New Self awareness.

Student learning outcomes

- Able to answer the question: What do I stand for?
- Ability to apply a coherent set of moral principles within professional and specialized contexts
- Willing to make unpopular but right decision
- Committed to working for justice and peace locally and globally.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Text & References:

Cassuto Rothman, J. (1998). From the Front Lines, Student Cases in Social Work Ethics. Needham Heights, MA: Allyn and Bacon.
Gambrill, E. & Pruger, R. (Eds). (1996). Controversial Issues in Social Work Ethics, Values, & Obligations. Needham Heights, MA: Allyn and Bacon, Inc.

Français-IV

CourseCode: FLU444 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student’s inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills,oral(dialogue,telephone conversations,etc.)and writtenandperformsimple communicationtaskssuchas

- talkingaboutpersonalhabits
- narratingevents inthe past,markingthestages,usingappropriateconnectors
- holdingconversationsontelephone
- askingfor/givingadvices

CourseContents:

Dossier7–pg65-74, Dossiers1,2and3(révision) Dossier7:auboulotActesdeCommunication:

Parlerdeshabitudesetdécrireunesituationàl’imparfait,comparer(nometverbe),qualifier(qui,que)s’exprimer

autéléphone,demanderet donnerunavis.

Dossiers1,2,3–Révision

Exercicesd’écoute,productionorale et écrite.

Grammaire :

1. l’imparfait,
2. lacomparaisonduverbe/dunom ; mieux/meilleur
3. lespronomsrelatifs

ExaminationScheme:

	INTERNAL				EXTERNAL	GRAND TOTAL
Components	MID-SEM	VIVA-VOCE	ATTENDANCE	**TOTAL**	**END SEMESTER**	**100**
Weightage (%)	15	10	5	**30**	**70**	

Text &References:

Text:

Le livre àsuivre:

· Andant, Christineet al.A proposA1Livre del’élève.Grenoble:Pressesuniversitairesde Grenoble, 2010.

· Andant, Christineet al.A proposA1Cahierd’exercices.Grenoble:Pressesuniversitairesde Grenoble, 2010.

Référence:

· Girardeau, Brunoet NellyMous.Réussirle DELFA1

PLANT BIOTECHNOLOGY

Course Code: BSC 501 **Credit Units: 04**

Course Objective:

The course aims to make the students understand the basic techniques of plant tissue culture. The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation.

Learning outcomes:

After successful completion of the course student will be able to:

- Handle the basic instruments used in plant biotechnology.
- Learn Preparation of stocks for culture media.
- Learn surface sterilization of different explants
- Understand *in-vitro* germination of seeds, seed viability and their maintenance in lab.
- Get training of problems related to germination, callus induction and propagation.

Course Contents:

Module I: Introduction to in vitro methods

Terms and definitions. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization, and its applications. Endosperm culture and production of triploids.

Module II:Introduction to the processes of embryogenesis and organogenesis and their practical applications

Micropropagation, axillary bud, shoot-tip and meristem culture. Haploids and their applications. Somaclonal variations and applications (Treasure your exceptions).

Module III: Introduction to protoplast isolation

Principles of protoplast isolation and applications. Testing of viabilityof isolated protoplasts. Various steps in the regeneration of protoplasts. Introduction of somatic hybridization. Various methods for fusing protoplasts, chemical and electrical. Cybrids- definition and application.

Module IV: Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants

Introduction to *A tumefaciens*. Tumor formation on plants using *A.tumefaciens* (Monocots vs. Dicots). Practical application of genetic transformation.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing

References:

- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
- Plant Tissue Culture: Theory & Practice, S.S. Bhojwani and M.K. Razdan, Elsevier Health Sciences

GENETICS & ANIMAL BIOTECHNOLOGY

Course Code: BSC 502 **Credit Units: 04**

Course Objective:

The objectives of the course is to focus on the concepts of Gene and mutation, molecular genetics, *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Learning outcomes:

Having successfully completed this course, students will be able to:

- Understand the concept of gene in terms of recon, muton and cistron including both classical and modern concept.
- Know various chemical and physical mutagens involved in causing mutation.
- Understand theory of animal cell culture, culture media, methods to develop cell lines. and their maintenance for commercial applications.
- Understand scale up production of monoclonal antibodies and hybridoma technology.
- Understand the structure and function of variety of hormones and growth factors, concept behind *invitro* fertilization and embryo transfer, and development of superior live stocks.

Course Contents:

Module I

Classical and modern concept of gene, pseudoallelism, position effect, intragenic crossing over and complementation test, Benzers work on rII locus in T4 Bacteriophage.

Module II

Mutation; spontaneous and induced, Mutagen;chemical and physical. Chromosomal aberrations;structural and numerical. Economic importance of mutation. Genetic disorders in human;Kleinefelter, Turner, Cri-du-Chat and Down syndrome.

Module III

Introduction of animal cell culture substrate, culture media, preservation and maintenance of cell lines. Production of monoclonal antibodies. Bioreactors for large scale culture of cells.

Module IV

Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF,erythropoietin). Transgenic animals. *In vitro* fertilization and embryo transfer.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Culture of Animal Cells, R.I Freshney, Wiley-Leiss.
- Principles of Genetics, E. J. Gardner, John Wiley & Sons Inc.
- Genetics, P.K. Gupta, Rastogi Publication.

References:

- Animal Cell Culture – A Practical approach, J.R.W. Masters, Oxford.
- Animal Cell Culture Techniques, M. Clynes, Springer Verlag.
- Cell Culture LabFax, M. Butler and M. Dawson, Bios scientific Publications Ltd.
- Cell Growth and Division – A Practical approach, R. Basega, IRL Press.
- Comprehensive Biotechnology, Moo-Young, Alan T. Bullm Howard Dalton, Panima Publication. Concepts of Genetics (Sixth Edition), William S. Klug and Michael R, Cummings, Pearson Education.
- Genetics, M.W. Strickberger, Prentice Hall College Division.
- Genetics, P.J. Russell, Benjamin/Cummings.

CHEMISTRY - V

Course Code: BSC 503 **Credit Units: 05**

Course Objective:

The students will learn about the various laws and conditions related to quantum mechanics, behavior of acid & base, metal & metal complexes and organometallic compounds

Learning Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences

- To understand the very basic bonding mechanism and the application to materials in different field.
- To understand the concept of Quantum Chemistry and its application
- To understand Hard & Soft Acid and Base concepts and its application
- To understand Organometallic & Bioorganic Concept

Physical Chemistry

Module I: Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect.

De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interprtation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Molecular orbital theory, basis ideas - criteria for forming M.O. from A.O., construction of M.O. 's LCAO-H2+ ion, calculation of energy levels from wave functions, concept of α, α* π, π*orbitals and their characteristics, Hybrid orbitls-SP, SP^2, SP^3 ; calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H2, comparison of M.O. and V.B. models.

Inorganic Chemistry

Module II: Hard and Soft Acids and Bases (HSAB) & Silicones and Phosphazenes

Hard and Soft Acids and Bases (HSAB)

Classification of acids and baes as hard soft. Pearson's HSAB concept , acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativityand hardness and softness.

Silicones and Phosphazenes

Silicones and phosphazenes as examples of inorganic, polymers, nature of bonding in triphosphazenes.

Module III: Metal-ligand Bonding in Transition Metal Complexes

Limitations of Valence bond theor, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes, factors affecting the crystal -field parameters.

Theromodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic satbility of metal complexes and factors affecting the stability, substitution: reactions of square planer complexes.

Module IV: Magnetic Properties of Transition Metal Complexes

Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of µs (spin only) and µeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Electron Spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy Level diagram for d1 and d9 states, discussion of the electronic specturm of [Ti(H2O)6]3+ complexion.

Module V Organometallic Chemistry

Definition, nomenclature and classification of organometallic componds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogenous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Module VI: Bioinorganic Chemistry

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca2+. Nitrogen fixation.

Text & References:

Text:

1. Test book of Inorganic Chemistry, P.L. Soni, Sultan Chand & Sons
2. Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co.
3. Principles Of Bioinorganic Chemistry Paperback – 1997, Jeremy M Berg Stephen J Lippard

References:

1. Advanced Inorganic Chemistry Vol-I & II, Satya Prakash, G.D. Tuli, S.K. Basu, R.D. Madan, S. Chand &Co. Ltd.
2. Simplified Course in Inorganic Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
3. Concise Inorganic Chemistry, J.D. Lee, Black Well Sciences
4. Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co. Ltd.
5. Simplified course in Physical Chemistry, Madan & Tuli, S. Chand & Co. Ltd.
6. Atkin's Physical Chemistry, Atkin, Oxford Press.
7. Physical Chemistry, Vemulapalli, Printice Hall of India

PLANT BIOTECHNOLOGY

Course Code: BSC 520 **Credit Units: 02**

Module I
Sterilization of glasswares and equipments.
Preparation of cotton plugs and culture media
Preparation of stocks for culture media
Preparation of culture media

Module II
Preparation and sterilization of different explants
Inoculation of explants on culture media

Module III
Study of viability of seeds

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

GENETICS & ANIMAL BIOTECHNOLOGY LAB

Course Code: BSC 521 **Credit Units: 02**

Module I: Genetics
Study of mendalian ratios
Study of bacterial conjugation
Module II
Study of gene interaction
Study of chromosome structure & size
Study of Genetics disorder in human
Module III
Culture of animal cell line.Preparation of competent cells by calcium chloride method.

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - V

Course Code: BSC 522 **Credit Units: 02**

Course Contents:

INORGANIC CHEMISTRY

Module I

Synthesis and Analysis

(a) Preparation of sodium trioxalato ferrate (III), Na_3 $[Fe(C_2O_4)_3]$ and determination of its composition by permagnatometry.

(b) Preparation of Ni-DMG complex [Ni $(DMG)_2$].

(c) Preparation of copper tetraamine complex, $[Cu(NH_3)_4]SO_4$.

(d) Preparation of cis-and trans-bisoxalato diaqua chromate (III) ion.

Instrumentation

Colorimetry

(a) Job's method, **(b)** Mole-ration method

Adulteration-Food stuffs, Effluent analysis, water analysis

Solvent Extraction

Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method

Separation and estimation of Mg(II) and Zn(II)

PHYSICAL CHEMISTRY

Module II

Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g. MnCl2. 4H2O/ SrBr2. 2H2O).

Phase Equilibrium

2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that soluble in the given phenol-water system.
3. To construct the phase diagram of two component (e.g. diphenylamine- benzophenone) system by cooling curve method.

Thermochemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine DH of the dissolution process.
2. To determine the enthalpy of neutralization of a week acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionisation of the weak acid/ weak base.
3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber Cycle.

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILL-V

Course Code: BCU 541 **Credit Units: 1**

Course Objective:

- To enable the students to adopt strategies for effective reading and writing skills.
- The course would enhance student's vocabulary, language and fluency. It would also teach the students to deliver professional presentations.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Vocabulary** • Define Vocabulary • Significance of Vocabulary • One Word Substitution, Synonyms & Antonyms and Idioms & Phrases • Define and Differentiate Homonyms, Homophones and Homographs • Vocabulary Drills • Foreign Words	**35% Weightage**
2.	**Module II Comprehension Skills** • Reading Comprehension-SQ3R Reading Techniques • Summarising and Paraphrasing • Précis Writing • Listening Comprehension	**25% Weightage**
3.	**Module III Presentation Skills** • Discussing the Significance of Audio-visual Aids, Audience and Feedback in Presentation Skills • Analyzing the Significance of Non-Verbal Communication	**30% Weightage**
4.	**Module IV Prose** • How Far is the River-Ruskin Bond • My Wood-E.M.Forster • I have a Dream-Martin Luther King • Spoken English and Broken English-G.B. Shaw	**10% Weightage**
5. 6.	**Student Learning Outcomes:** • Communicate fluently and sustain comprehension of an extended discourse. • Demonstrate ability to interpret texts and observe the rules of good writing. • Prepare and present effective presentations aided by ICT tools. **Pedagogy for Course Delivery:** Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Components (Drop down)	CIE	Attendance	**End Term Examination**
Weightage (%)	25%	5%	70%

Text: **Jaffe, C.I. Public Speaking: Concepts and Skills for a Diverse Society, 4th ed. Belmont, CA: Wadsworth, 2004.**
Effective English for Engineering Students, B Cauveri, Macmillan India
***Creative English for Communication*, Krishnaswamy N, Macmillan**

Reference: ***A Textbook of English Phonetics*, Balasubramanian T, Macmillan**

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE-V

Course Code: BSU-543 **Course Credit: 01**
Total Hours: 10

Course Objective:

- To inculcate in the students an elementary level of understanding of group/team functions
- To develop team spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation (2 Hours)

- Definition and Characteristics
- Importance of groups
- Classification of groups
- Stages of group formation
- Benefits of group formation

Module II: Group Functions (2 Hours)

- External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.
- Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.
- Group Cohesiveness and Group Conflict
- Adjustment in Groups

Module III: Teams (2 Hours)

- Meaning and nature of teams
- External and internal factors effecting team
- Building Effective Teams
- Consensus Building
- Collaboration

Module IV: Leadership (2 Hours)

- Meaning, Nature and Functions
- Self leadership
- Leadership styles in organization
- Leadership in Teams

Module V: Power to empower: Individual and Teams (2 Hours)

- Meaning and Nature
- Types of power
- Relevance in organization and Society

Student learning outcomes

- Students will Develop critical and reflective thinking abilities
- Students will Demonstrate an understanding of group dynamics and effective teamwork
- Student will develop a range of leadership skills and abilities such as effectively leading change, resolving conflict, and motivating others
- Student will Gain knowledge and understanding of organization resources, policies, and involvement opportunities.
- Student will Develop strategies to recruit, retain, and continually motivate contributing members to the organization

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

Français-V

CourseCode: FLU544 **Creditunits:02**

CourseObjective:

Tostrengthenthe language ofthe student's inbothoral andwritten

Torevise the grammarinapplicationandthe communicationtasksrelatedtotopicscoveredalready

Toget acquaintedwiththe current socialcommunicationskills, oral (dialogue, telephone conversations,etc.)And writtenandperformsimple communicationtaskssuchas

_ narratingevents inthe past, markingthestages, usingappropriateconnectors
_ expressingcausesandconsequences, usingappropriate logical connectors
_ presentingabiography

CourseContents:

Dossier8Pg7584Dossiers4,5and6(révision) Dossier8:Vivre ensembleActesdeCommunication:

Exprimerlacause,l'opposition,laconséquence,décrirelesétapesd'uneaction,s'exprimersurl'environnement,
l'écologie,identifieret décrirelesdifférencesde comportement,décrire le fonctionnementd'une association,fairela biographied'une personne.

Dossiers4, 5,6–Révision

Exercicesd'écoute,productionorale et écrite.

Grammaire :

1. le présent (révision),lepassé composé(révision)
2. lespronomscomplémentsdirects,lespronomscompléments indirects
3. lesmarqueurschronologiques
4. lesarticulateurslogiques

ExaminationScheme:

	INTERNAL				**EXTERNAL**	**GRAND**
Components	MID-SEM	VIVA-	ATTENDANC	**TOTAL**	**END**	
Weightage	15	10	5	**30**	**70**	**100**

Text &References:

Text:

Le livre àsuivre:

· Andant,Christineet al.A proposA1Livre del'élève.Grenoble:Pressesuniversitairesde Grenoble,2010.

· Andant,Christineet al.A proposA1Cahierd'exercices.Grenoble:Pressesuniversitairesde Grenoble,2010.

Références:

· Girardeau,Brunoet NellyMous.Réussirle DELFA1.Paris: Didier,2010

PLANT ECOLOGY

Course Code: BSC 601 **Credit Units: 04**

Course Objective: The paper is designed for developing understanding of modern ecological processes and factors affecting growth and distribution of vegetation, principles of management of natural resources through holistic approach. The distribution of population of different species, their dynamics, communities and ecosystems.

Learning Outcome:

1. The students will develop an understanding of modern ecological concepts through holistic approach about populations, communities and ecosystems
2. Would provide information about various ecological processes and factors affecting growth and distribution of vegetation, principles of management of natural resources
3. Identify the significance of plant cover as an indicator of change in the environment, and as an active participant in the formation of environmental conditions or habitat types.
4. The course content will help the students to analyse the interrelationships of all the biotic and abiotic components with the environmental conditions, with independent recognition and classification of taxa.
5. The students will develop the expertise in differentiating properties of terrestrial, aquatic and marine ecosystems and the accompanying communities.

Unit-I

Introduction to the Biosphere: Inter-relationships between the living world and the environment, the components and dynamism, Homeostasis. Environment factors, Climatic factors: Composition and stratification of atmosphere, Topographic factors, Edaphic factors, Biotic factors.

Unit-II

Levels of Organization, Population and Communities: concepts of autecology, synecology; concept of biological diversity; habital and ecological niche. Distribution and characteristics of populations; population dynamics; Ecological Speciation. Community characters (analytical and synthetic), ecotone and edge effect; plant succession, processes, type; primary and secondary succession; climax concepts.

Unit-III

Ecosystems: Structure, biotic and the abiotic components; trophic organization, source of energy, autotrophy, heterotrophy, parasitism; food chains and webs; ecological pyramids; biomass. Energy flow; biogeochemical cycles; dynamics: hydrologic cycle; gaseous cycles, sedimentary cycles.

Unit-IV

Diversity of Ecosystems, Biomes and Phytogeography: major terrestrial biomes: tundra, temperate and tropical. Principles of phytogeography; endemism; hotspots; phytogeographical divisions of India: Vegetation of Gwalior. Conservation of natural resources forests and biodiversity.

References:

1. Singh, J.S. singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi
2. Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach. Oxford.
3. Daubenmier, R.F. (1970). Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited
4. Daubenmier, R.F. (1970). Plants Communities, Willey Eaastern Private Limited
5. Odum, E. (2008) Ecology. Oxford and IBH Publisher.

Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.

APPLIED ZOOLOGY

Course Code: BSC 602 **Credit Units: 04**

Course Objectives:
The course is unique in highlighting the commercial and industrial significance/value of animals. It discusses the techniques/ methods of rearing of animals for commercial usage and the prerequisites for their successful maintenance and sustenance. The students will also study the basic toxicokinetic principles and metabolic systems to elucidate mechanisms of toxicity induced by xenobiotic compounds. To provide a strong foundation and motivation for applying fundamental concepts of Zoology in basic research to meet global challenges.

Learning Outcomes:
After Successful completion of the course graduates will be able to:
1. Employ scientific methodologies to understand and apply relevant scientific principles.
2. Understand the culture techniques of prawn, pearl and fish.
3. Understand silkworms & lac rearing and their products.
4. Understand the Bee keeping and Apiary management.
5. Understand the process of preparation of buffer, fixatives, stains and reagent.
6. Learn the techniques of Microtomy, chromatography and taxidermy.

Unit : I Aqua culture :
1. Definition, scope and significance of aquaculture.
2. Prawn Culture.
3. Pearl Culture.
4. Edible Oyster Culture.
5. Frog Culture

Unit : II Pisciculture
1. General account of freshwater edible fishes.
2. Carp culture.
3. Maintenance of aquarium.
4. Plankton and their role in fisheries.
5. Elementary knowledge of poly-culture.

Economic Entomology
General account of :-
1. Sericulture.
2. Apiculrture.
3. Lac Culture.
4. Common pests of oil seeds, vegetables and stored grains.
5. Biological control of insect-pests.

Unit IV Toxicology
1. Toxicology : Basic concept.
2. Toxicity testing LC50, LD50 acute and chronic toxicity.
3. Heavy metal toxicity (mercury, cadmium and lead).
4. Pesticides and their toxicological effects.
5. Occupational health hazards and their control.

Unit : V Lab techniques
1. Study of pH meter and chromatography.
2. Microtomy.
3. Preparation of fixatives, stains and regents.
4. Museum keeping - preservation and skeleton prepartion, taxidermy.

CHEMISTRY - VI

Course Code: BSC 603 **Credit Units: 04**

Course Objective:

The students will learn about the various laws and conditions related to electromagnetic spectrum, polymer, heterocyclic compounds, bimolecules and their derivatives.

Course Outcomes:

After successful completion of the course students will have the knowledge and skill to:
Apply the principles chemical of sciences:

- To understand the very basic bonding mechanism and the application to materials in different field.
- To understand the spectroscopic concept like NMR, IR, UV, Photochemistry
- To understand polymer synthesis, properties and application in various field
- To understand synthesis and applications of carbohydrates, fatty acids & oils
- To understand synthesis and applications of amino acids, peptides, proteins

Physical Chemistry
Module I: Spectroscopy & Photochemistry
Spectroscopy
Introduction: electromagnetic radiation, regions of the spectrum, basis features of different spectrometers, statement of the Born-Oppenheimer approximation, degree of freedom.
Spectroscopy
Nuclear magnetic resonance (NMR) spectroscopy.
Proton magnetic resonance (1H NMR) spectroscopy, nuclear shielding; and Deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol. acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.
Photochemistry
Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus - Draper law, Stark-Dinstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions energy transfer processes (simple examples.)
Organic Chemistry
Module II Synthetic Polymers
Addition or chin-growth polymerization. Free radial vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.
Module III. Heterocyclic Compounds
Introduction: Molecular orbital picture and aromatic character of pyrrole, furan, thiophene and pyridine. Methods is synthesis and chemical reactions with emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.
Introduction to condensed five and six -membered heterocycles. Preparation and reactions of indole, quinoline an isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler - Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.
Module IV: Carbohydrates, Fats, Oils, Detergents & Synthetic Dyes
Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chin lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esteres. Determination of ring size of monosaccharides. Cyclic structure of D(+)- glucose. Mechanism of mutarotation.
Stuructures of ribose and deoxyribose.
An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch nad cellulose) without involving structure determination.
Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, idoine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates.
Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alzarin and Indigo.
Module V: Amino Acids, Peptides, Proteins and Nucleic Acids
Classification, Structure and stereochemistry of amino acids, Acid -Base behaviour isoelectric point and electrophoresis. Preparation and reactions of a-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structure of peptides and proteins, levels of protein structure. Protein denaturation/renaturation.
Nucleic acids: Introduction, Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

Course Code: BCH 623 **Credit Units: 01**

Course Objective:

The Management and Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era.

The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Course Contents:

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective.

Module II

Formal and informal organization, Performance appraisal, Training and development.

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business.

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
- David H Holt, Entrepreneurship : New Venture Creation

References:

- The Practice of Management, P. Drucker, Harper Business

PLANT ECOLOGY & APPLIED ZOOLOGY LAB

Course Code: BSC 620 **Credit Units: 02**

Plant Ecology:

1. Analysis of soil: pH and organic matter.
2. Study of the water holding capacity and texture of soil.
3. Analysis of water: Turbidity, conductivity and Dissolved Oxygen.
4. Study of vegetation by quadrat method.
5. Determination of Frequency, density and abundance of plant species
6. Study of the biodiversity, biodiversity hotspots, Vegetation of Gwalior region

Applied Zoology:

1. Morphological characterization of common fish species.
2. Identification of two major carps – Labeo rohita and Catla catla and their life cycles.
3. Mounting of the sting apparatus.
4. Worker honey bee with emphasis on leg modifications (through specimens/charts) and whole mount preparation of the 3 pairs of legs.
5. Life cycle of mulberry silkworm, Bombyx mori (model/chart/specimens)
6. Insect collection and preservation for systematic studies.
7. Separation of amino acids/dyes/sugar by paper chromatography
8. Preparation of buffer solutions of defined ionic concentration and determination of pH
9. Microtomy of animal materials (tissue fixation, processing, paraffin block preparation, sectioning, staining and mounting)

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

CHEMISTRY LAB - VI

Course Code: BSC 621 **Credit Units: 02**

Course Contents:

ORGANIC CHEMISTRY

Module I
Laboratory Techniques
Steam Distillation
Naphthalene from its suspension in water
Clove oil from cloves
Separation of -and p-nitrophenols
Column chromatography
Separation of fluorescein and methylene blue
Separation of leaf pigments from spinach leaves
Resolution of racemic mixture of (+) mandelic acid
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PHYSICAL CHEMISTRY

Module II
Electrochemistry
(a) To determine the strength of the given conductometrically using standard alkali solution.
(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
(c) To study the saponification of ethyl acetate conductometrically.
(d) To determine the ionisation constant of a weak acid conductometrically.
(e) To titrate potentiometrically the given ferrous ammonium sulphate solution using KMnO4/ K2Cr2O7 as titrant and calculate the redox potential of Fe+++ system on the hydrogen scale.
Refractometry, Polarimetry
(a) To verify law of refraction of mixture (e.g. of glycerol and water) using Abbe's refractometer.
(b) To determine the specific rotation of a given optically active compound.
Molecular Weight Determination
(a) Determination of molecular weight of a non-volatile solute by Rest method/ Beckmann freezing point method.
(b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.
Colorimetry
To very Beer-Lambert law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

IA			EE			
Class Test (Practical Based)	**Mid Term Viva**	**Attendance**	**Major Experiment**	**Minor Experiment/Spotting**	**Practical Record**	**Viva**
15	10	05	35	15	10	10

COMMUNICATION SKILLS VI

Course Code: BCU 641 **Credit Units: 1**

Course Objective: The main emphasis of this course is to enable students to learn the dynamics of social communication and to demonstrate the ability to learn the nuances of informal communication.

Prerequisites: NIL

Course Contents / Syllabus:		
1.	**Module I Social Communication Essentials** • Small talk • Building rapport • Expand social and Corporate Associations • Informal Communication: Grapevine, Chat	**30% Weightage**
2.	**Module II Workplace Interpersonal Skills** • Understanding Social Communication in Workplace environment. • Employee feedback: Assess employee performance and satisfaction. • Simulation ➢ **Humour in Communication-Use of 'Puns'** ➢ **Entertainment and Communication (Infotainment)** • Infotainment and Social Media • Entertainment in Journalism ➢ **Social Networking**	**25% Weightage**
3.	**Module III Visual Code / Social Etiquette** • Power Dressing • Fine Dining • Office Party Etiquette • Business Travel Etiquette ➢ **Work Place and Business Etiquette** • Proper Greetings • Thank You Notes • Telephonic Manners/ Voice Mail Etiquette • Business Salutation Etiquette • Guest Etiquette • Cubicle Etiquette • Business Card Etiquette ➢ **Different Cultural Etiquette & Protocol**	**35% Weightage**
4.	**Module IV Prose** • Secret of Socrates - Dale Carnegie • My Financial Career-Stephen Leacock • The Luncheon - W. Somerset Maugham • The National Flag - Jawahar Lal Nehru All the four stories will be discussed in one class One Long Question will be set in the Exam from the Text	**10% Weightage**
5.	**Student Learning Outcomes:** • To communicate contextually in specific personal and professional situations with courtesy. • To inject humour in their regular interactions. • To strengthen their creative learning process through individual expression and collaborative peer activities.	
6.	**Pedagogy for Course Delivery:** • Workshop • Group Discussions • Presentations • Lectures	
7.	**Assessment/ Examination Scheme:**	

Theory L/T (%)	**Lab/Practical/Studio (%)**	**End Term Examination**
100%	NA	70%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment			**End Term Examination**
Components (Drop down)	CIE	Attn	
Weightage (%)	25%	5%	70%

Text: *Krizan, Merrier, Logan & Williams. Effective Business Communication, New Delhi: Cengage, 2011*

- *Communication and Organizational Culture*. Keyton. Joann. Sage Publications
- *Social Communication (Frontiers of Social Psychology)*.Fiedler, Klaus. Psychology Press

Reference: *Cypherpunks: Freedom and the Future of the Internet.* Assange, Julian Assange. OR Books.

Additional Reading: Newspapers and Journals

BEHAVIOURAL SCIENCE -VI

Course Credit: 01

Course Code: BSU-643

Total Hours: 10

Course Objective:

- To develop an understanding the concept of stress its causes, symptoms and consequences.
- To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

Course Contents:

Module I: Stress **(2 Hours)**

- Meaning & Nature
- Characteristics
- Types of stress

Module II: Stages and Models of Stress **(2 Hours)**

- Stages of stress
- The physiology of stress
- Stimulus-oriented approach.
- Response-oriented approach.
- The transactional and interact ional model.
- Pressure – environment fit model of stress.

Module III: Causes and symptoms of stress **(2Hours)**

- Personal
- Organizational
- Environmental

Module IV: Consequences of stress **(2 Hours)**

- Effect on behavior and personality
- Effect of stress on performance
- Individual and Organizational consequences with special focus on health

Module V: Strategies for stress management **(2 Hours)**

- Importance of stress management
- Healthy and Unhealthy strategies
- Peer group and social support
- Happiness and well-being.

Student learning outcomes

- Student will able demonstrate thorough understanding of stress and its effects
- Student will able to learn various coping strategies to deal stress effectively so to overcome the consequences and impact of stress on their health and wellbeing, ultimately it will enhance their performance.

Examination Scheme:

Evaluation Components	Attendance	Journal of Success (JOS)	Social Awareness Program (SAP) SAP Report/SAP Presentation	End Semester Exam	Total
Weightage (%)	5	10	15	70	100

Suggested Readings:

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience.

FRENCH - VI

Course Code: FLU 644 **Credit Units: 02**

Course Objective:

To strengthen the language of the students both in oral and written so that they can:

i) express their sentiments, emotions and opinions, reacting to information, situations;

ii) narrate incidents, events;

iii) perform certain simple communicative tasks.

Course Contents:

Module D: pp. 157 – 168 – Unité 12

Unité 12: s'évader

1. présenter, caractériser, définir
2. parler de livres, de lectures
3. préparer et organiser un voyage
4. exprimer des sentiments et des opinions
5. téléphoner
6. faire une réservation

Contenu grammatical:

1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
2. Faire + verbe

Examination Scheme:

Components	**CT1**	**CT2**	**C**	**I**	**V**	**A**
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- lelivre à suivre : Campus: Tome 1

PROJECT

Course Code: BSC 660 **Credit Units: 12**

GUIDELINES FOR PROJECT FILE

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.
The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. Project Report Organization

The Project report must be organized as follows. Format for few report pages is given after these guidelines:

1.1 Title of the Report

The title of the report should remain same as that given in the synopsis.

1.2 Title Page

The title page should be similar to the cover page but should contain a few additional items. This page will not only bear the title of the report and the candidate's name, but also the name of the degree for which the report is submitted, the name of the Institute, month and year of submission of the report.

1.3 Declaration by the Students

This is page number (i), the beginning of the small case Roman numeral page numbers. The student has to give a declaration to the effect that the data used for the work, the work depicted in the report, and the written material contained in the report are not copied from others and that due permission has been taken from, and due credit has been given to, the sources whenever they are used.

1.4 Certificate

This is page number (ii). The certificate will be signed by the Faculty Supervisor(s) before the viva-voce after verifying the format and by the Head of the Department after review with the Supervisor(s).

1.5 Acknowledgements

This is page number (iii). Keep this brief and avoid using informal language. This page must be signed by the candidate.

1.6 Abstract and Keywords

This is page number (iv). The abstract (preferably one page) should contain the context/relevance of the problem at hand, a description of what was done and a gist of the significant observations/results.
The keywords (maximum 6) are a hint that what is contained in the report.

1.7 Contents

This is page number (v). The table of Contents should be titled just *Contents* (not Table of Contents). Try to fit it into one or two pages.

1.8 List of Figures and List of Tables

Use separate pages for list of figures and list of tables. . Each list should give, in tabular form, the figure or table number, its title/caption and its page number.

1.9 Nomenclature and Abbreviations

All symbols that appear in the report should be listed alphabetically. First give all Roman symbols, then Greek symbols.

1.10 List of Acronyms and Standards

1.11 The Chapters

Each chapter should begin with an Introduction and end with a Conclusion (a summing up) and, where applicable, a lead-in to the next chapter. The page on which chapter 1 starts is page 1. One chapter should follow immediately after another. Do not use an intervening blank or title page between chapters.
Each of the other chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.

1.12 References/ Bibliography

Number all the references. Use alphabetical ordering for referencing. Each listed reference must be cited in the text of the report. (Use prescribed format according to International guidelines)

1.13 Appendices (if applicable).

Number the Appendices A, B, etc. Figures, tables and equations in an appendix are numbered as in the case of a chapter with the appendix letter taking the place of the chapter number.

2. Production of Project Report

2.1 Report Size

The maximum number of pages of the Report should be preferably between 30-50 pages.

2.2 Paper Size

The standard size of paper of a Report is A4 paper must be used for printing the report.

2.3 Single-Sided Printing

It is suggested that the report be printed on one side of the paper.

2.4 Non-Paper Material

Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. All non-paper materials must have a label each indicating the name of the student and the date of submission.

2.5 Binding

First submit a loosely bound report to your supervisor(s) for checking and after getting it checked the final report must be hard bound. *Refer* NTCC guidelines for colour coding scheme. Two copies (Minor project) and three copies (Major project/Dissertation) of hard bound report along with CD (report in MS-Word 2007 format) must be submitted to the department. The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) in gold.

3. Format of Project Report

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

3.1 Font

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

3.2 Margins

A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

3.3 Line Spacing

The line spacing in the main text must be between one-and-a-half (1.5). Single line spacing should be given for figure captions, table titles, figure legends, and footnotes. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text). Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

3.4 Tables and Figures

Each sketch, drawing, graph and photograph should have a figure number and title below the figure etc. Numbering should be sequential, chapter wise. For instance, if there are 24 figures chapter 3 spread over all of its sections the figure numbers run from Figure 3.1 through Figure 3.24. In figures experimental data should typically be represented by centered symbols, and theoretical data by continuous curves.
Each table should have a table number and caption above the table. Numbering should be sequential, chapter wise, as in the case of Figure numbers. For instance, if there are 18 tables in chapter 3 the table numbers run from Figure 3.1 through Figure 3.18.

Make sure that figures and tables are complete in other respects such as legends, references (if any) and coordinate labels with units. Each figure and table must be explicitly referred to in the text and located where its first reference occurs, preferably after the reference.

3.5 Drawings

All engineering drawings must conform to relevant Standards and should include a title block. If drawings are large they should be included at the back of the report in a separate pocket. In case drawings are made using CAD packages, a CD ROM should be included which contains all the files and details of the packages used.

3.6 Equations

The numbering of equations should be sequential, chapter wise. Numbered equations must be explicitly referred to in the text.

3.7 SI

Make sure proper units, SI as far as possible, appear wherever required.

- ### Title or Cover Page

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- ### Acknowledgements (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- ### Abstract

A good"Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- ## Table of Contents

Titles and subtitles are to correspond exactly with those in the text.

- ## Introduction

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- ## Review of Literature and Definition of Problem

- ## Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- ## Results and Discussion

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

- Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- ## Conclusion and Future prospects

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- ## Summary

- ## Appendices

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- ## References / Bibliography

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples

For research article

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* ,**8** (suppl 1): 116–117.

For book:

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

Chapter 1
(Chapter No: Times New Roman, 18 Pts.)

INTRODUCTION
(Chapter Name: Times New Roman, CAPS, 18 Pts., Bold)

1.1 Heading
(Main Heading: Times New Roman, 16 Pts., Bold)

1.1.1 Sub-Heading

(Sub- Heading: Times New Roman, 14 Pts., Bold)

1.1.1 (a) Subsections under Sub-Heading

(Sub- Sections: Times New Roman, 14 Pts., Italics)

For normal text Font Type and Size must be- Times New Roman, 12 pt. The minimum font size of materials within a table or a figure can be 10 point.

BIBLIOGRAPHY/REFERENCES (16 bold, caps)

Leave 1½" space from the top edge and 2 blank lines after the title. Page numbering is a continuation of preceding material. References should be in alphabetical order.
This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

ASSESSMENT OF THE PROJECT FILE

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

Range of Research Methods used to obtain information

Execution of Research

Data Analysis

Analyse Quantitative/ Qualitative information
Control Quality

Draw Conclusions

Examination Scheme:

Project Report	100
Viva voce	50
Total	**150**