

Master of Technology (Biotechnology)

Programme Code: MTB

Duration – 2 Years Full Time

**Programme Structure
And
Curriculum & Scheme of Examination
With
Choice Based Credit System (CBCS)
2020-22 Batch**

**AMITY UNIVERSITY
RAJASTHAN**

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:

<u>Components</u>	<u>Codes</u>	<u>Weightage (%)</u>
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.

PROGRAMME OVERVIEW

Biotechnology in the present scenario is helping by showing advancement in diagnosis of a disease by helping us to move forward from primitive Symptomatic Treatment to modern Molecular Treatment along with rapid organization and analysis of biological data possible (Bioinformatics), Marine and aquatic applications of Biotechnology used to improve cleanup of toxic spills, improve yields of fisheries (Blue Biotechnology), Agricultural use of Biotechnology, heading towards the production of crops in not only good quantity but also with good quality (Green Biotechnology), Medicine including designing of organisms to produce antibiotics and the engineering of genetic cures through genomic manipulation (Red Biotechnology), Exemplified by the designing of an organism to produce useful chemicals, use of enzymes as industrial catalysts (White Biotechnology).

In view of above Amity University Rajasthan running Bachelors, Master and Ph.D biotechnology programs to fulfill the demand of various biopharmaceutical and biotechnological industries. All these programs course curriculum and structure have been designed in consultation with various pharmaceutical, biotechnological and dairy industry experts to meet the demand and supply of technical qualified personals. The course curriculum covering the major part of advanced biotechnological process, bioprocess and downstream technology, enzyme technology, separation technology, immunology, virology, genetics, molecular modeling drug design, biopharmaceuticals, pharmaceutical biotechnology, and bioinformatics in relation to the industry requirements.

The MSc. programme in Biotechnology seeks to provide education and training, empower students with technical skill-set, create capacities and build career opportunities in four key domains of biotechnology namely:

- Research and Development (Academic & Research Institutions and Industrial Sectors)
- Biotechnology Industries, Breweries, Pharmaceutical & Food Industries
- Forensic, Diagnostics Centers and Regulatory agencies
- Data handlings, Coding and Clinical research

This is achieved through a combination of interdisciplinary curricula as well as intensive laboratory work. Through its unique pedagogical methods, the academic programme allows transferability of acquired skills in domains unrelated to biotech sectors. Students are expected to have both specialized knowledge and practical experience for addressing contemporary problems in both academic and industrial setting.

Program Learning Outcomes (PLO):

The objective of the programme is to highlight the role played by biotechnology in modern society and its relevance to sustainable development. It seeks to provide the following:

PLO-I	:	Graduates will be able to identify, analyze and understand problems related to biotechnology engineering and finding valid conclusions with basic knowledge in biotechnology engineering with special emphasis on optimization and scale up.
PLO-II	:	Graduates will be able to design and develop solution to biotechnology engineering problems by applying appropriate tools while keeping in mind safety factor for healthy environmental & society.
PLO-III	:	Solve organizational problems arising from a legal and technology framework and products, exhibit professionalism, ethical attitude to become an entrepreneur.
PLO-IV	:	Identify, evaluate and assess risks and payoffs in monetary and non-monetary terms and Ability to work with multidisciplinary subjects in industries and research.

Credit Summary Sheet

M. Tech. Biotechnology							
Semester	CC	DE	VA	OE	NTCC	Anandam	Total
1	17	3	4	-	-	2	26
2	18	3	4	3	-	2	30
3	18	3	4	3	-	2	30
4	-	-	-	-	30	-	30
Total	53	09	12	06	30	6	116

Note:- CC - Core Course, VA - Value Added Course, OE - Open Elective, DE - Domain Elective

List of Open Electives from M.Tech Biotechnology						
From M.Tech Biotech						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MTB 231	Medical Biotechnology	CC	3	-	-	3
MTB 304	Recombinant DNA Technology	CC	3	-	-	3

Program Structure

M. Tech. Biotechnology: I Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MTB101	Advanced Biochemistry & Metabolic Regulation	CC	3	-	-	3
MTB102	Advanced Microbial Biotechnology	CC	3	1	-	4
MTB103	Advanced Bioinformatics	CC	3	-	-	3
MTB104	Cellular and Molecular Biotechnology	CC	3	-	-	3
MTB121	Advanced Biochemistry & Metabolic Regulation Lab	CC	-	-	2	1
MTB122	Advanced Microbial Biotechnology Lab	CC	-	-	2	1
MTB123	Advanced Bioinformatics Lab	CC	-	-	2	1
MTB124	Cellular and Molecular Biotechnology Lab	CC	-	-	2	1
AND001	ANANDAM-I	NTCC	-	-	-	2
DE Electives: Student has to select 1 course from the list of following DE electives						
MTB130	Instrumentation in Biotechnology	DE	3	-	-	3
MTB131	IPR & Drug regulatory affairs	DE				
MTB132	Industrial Safety & Hazards	DE				
BCS 111	Communicational Skills - I	VA	1	-	-	1
BSS111	Behavioural Science I (Self Development and Interpersonal Skills)	VA	1	-	-	1
FLT 111 FLG 111 FLS 111 FLC 111	Foreign Language - I French German Spanish Chinese	VA	2	-	-	2
NCC001	Good Laboratory Practices	NCC	-	-	-	-
	TOTAL					26

Note: Common details for ANANDAM course given at the end of syllabus.

M. Tech. Biotechnology: II Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MTB201	Enzymology & Protein Engineering	CC	3	-	-	3
MTB202	Bioprocess & Fermentation Technology	CC	3	-	-	3
MTB203	Advanced Immunotechnology	CC	3	-	-	3
MTB204	Advance Biostatistics for Biologists	CC	3	-	-	3
MTB205	Research Methodology and Scientific Writing	CC	3	-	-	3
MTB221	Enzymology & Protein Engineering Lab	CC	-	-	2	1
MTB222	Bioprocess & Fermentation Technology Lab	CC	-	-	2	1
MTB223	Advanced Immunotechnology Lab	CC	-	-	2	1
AND002	ANANDAM-II	NTCC	-	-	-	2
DE Electives: Student has to select 1 course from the list of following DE electives						
MTB230	Environmental Biotechnology	DE	3	-	-	3
MTB231	Medical Biotechnology	DE				
MTB232	Pharmaceutical Technology & Biotechnology	DE				
OE	Open Elective -I	OE	3	-	-	3
BCS 211	Communicational Skills - II	VA	1	-	-	1
BSS211	Behavioural Science – II (Behavioral Communication and Relationship Management)	VA	1	-	-	1
FLT 211 FLG 211 FLS 211 FLC 211	Foreign Language - II French German Spanish Chinese	VA	2	-	-	2
TOTAL						30

M. Tech. Biotechnology: III Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MTB301	Bioprocess Plant Design	CC	3	-	-	3
MTB302	Downstream Processing	CC	3	-	-	3
MTB303	Nanobiotechnology	CC	3	-	-	3
MTB304	Recombinant DNA Technology	CC	3	-	-	3
MTB305	Genomics & Proteomics	CC	2	-	-	2
MTB322	Downstream Processing Lab	CC	-	-	2	1
MTB323	Nanobiotechnology Lab	CC	-	-	2	1
MTB324	Recombinant DNA Technology Lab	CC	-	-	2	1
MTB325	Genomics & Proteomics Lab	CC	-	-	2	1
AND003	ANANDAM-III	NTCC	-	-	-	2
DE Electives: Student has to select 1 course from the list of following DE electives						
MTB330	Advanced Food Technology	DE	3	-	-	3
MTB331	Tissue Engineering	DE				
MTB332	Drug Discovery & Development	DE				
OE	Open Elective-II	OE	3	-	-	3
BCS 311	Communicational Skills - III	VA	1	-	-	1
BSS311	Behavioral Science III (Leading Through Teams)	VA	1	-	-	1
FLT 311 FLG 311 FLS 311 FLC 311	Foreign Language - III French German Spanish Chinese	VA	2	-	-	2
	TOTAL					30

M. Tech. Biotechnology: IV Semester						
Course Code	Course Title	Category	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Credits
MTB460	Major Project /Dissertation	NTCC	-	-	-	30
	TOTAL					30

ADVANCED BIOCHEMISTRY AND METABOLIC REGULATION

Course Code: MTB101 **Credit Unit:03**

Theory

Course Objective:

The objectives of this course are to buildup on undergraduate level knowledge of biochemical principles with specific emphasis on different metabolic pathways. The course shall make the students aware of various disease pathologies within the context of each topic.

Course Contents:

Module I: Protein Structure

Chemical basis of life: Miller-Urey experiment, abiotic formation of amino acid oligomers, composition of living matter; Water – properties of water, essential role of water for life on earth pH, buffer, maintenance of blood pH and pH of gastric juice, pH optima of different enzymes (pepsin, trypsin and alkaline phosphatase), ionization and hydrophobicity, emergent properties of biomolecules in water, biomolecular hierarchy, macromolecules, molecular assemblies; Structure-function relationships: amino acids – structure and functional group properties, peptides and covalent structure of proteins, elucidation of primary and higher order structures, Ramachandran plot, evolution of protein structure, protein degradation and introduction to molecular pathways controlling protein degradation, structure-function relationships in model proteins like ribonuclease A, myoglobin, hemoglobin, chymotrypsin *etc.*; basic principles of protein purification; tools to characterize expressed proteins; Protein folding: Anfinsen's Dogma, Levinthal paradox, cooperativity in protein folding, free energy landscape of protein folding and pathways of protein folding, molten globule state, chaperons, diseases associated with protein folding, introduction to molecular dynamic simulation.

Module II: Glycobiology

Sugars-mono, di, and polysaccharides with specific reference to glycogen, amylose and cellulose, glycosylation of other biomolecules- glycoproteins and glycolipids; lipids- structure and properties of important members of storage and membrane lipids; lipoproteins.

Module III: Structure and functions of DNA, RNA and Lipids

Self-assembly of lipids, micelle, biomembrane organization - sidedness and function; membrane bound proteins - structure, properties and function; transport phenomena; nucleosides, nucleotides, nucleic acids - structure, a historical perspective leading up to the proposition of DNA double helical structure; difference in RNA and DNA structure and their importance in evolution of DNA as the genetic material.

Module IV: Bio-energetics

Bioenergetics-basic principles; equilibria and concept of free energy; coupled interconnecting reactions in metabolism; oxidation of carbon fuels; recurring motifs in metabolism; Introduction to GPCR, Inositol/DAG//PKC and Ca⁺⁺ signaling pathways; glycolysis and gluconeogenesis; reciprocal regulations and non-carbohydrate sources of glucose; Citric acid cycle, entry to citric acid cycle, citric acid cycle as a source of biosynthetic precursors; Oxidative phosphorylation; importance of electron transfer in oxidative phosphorylation; F₁-F₀ ATP Synthase; shuttles across mitochondria; regulation of oxidative phosphorylation; Photosynthesis – chloroplasts and two photosystems; proton gradient across thylakoid membrane.

Module V: Role of vitamins & cofactors in metabolism

Calvin cycle and pentose phosphate pathway; glycogen metabolism, reciprocal control of glycogen synthesis and breakdown, roles of epinephrine and glucagon and insulin in glycogen metabolism; Fatty acid metabolism; protein turnover and amino acid catabolism.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Lehninger, A. (2013). Principles of Biochemistry, 6th Ed., Nelson and Cox.
- Mathews, Van Holde & (2012). Ahern Biochemistry. 4th Edition.

References:

- Smith, E. L., Hill, R. L. Lehman, I. R. Lefkowitz, R. J. Handler, P. & White, A. (1983). Biochemistry 7th Ed. McGraw-Hill Book Company.
- Berg, J. M., Tymoczko, J. L. & Stryer, L. (1990). Biochemistry, 3rd Ed., W.H. Freeman and Company.
- Voet, D. V. & Voet, J. G. (2010). Biochemistry, 4th Ed. Wiley
- Conn, E. E. & Stumph, P. K. (1987). Outlines of Biochemistry, John Wiley & Sons.

ADVANCED MICROBIAL BIOTECHNOLOGY**Course Code: MTB102****Credit Unit:3L+1T****Theory****Course Objective:**

The objective of this course is to introduce students to the exciting area of microbial Biotechnology, To understand the habitual and application of microbes in different products and process.

Course Contents:**UNIT I: HISTORY AND SCOPE**

History and scope of microbial biotechnology, Microbial biodiversity and its use, Bergey's manual of systemic bacteriology, Microbial Genetics, Isolation, Strain improvement, Identification, Preservation and Maintenance of Industrial Microorganisms. Fermenter parts and components; Media for industrial fermentation; Sterilization.

UNIT II: MICROBIAL METABOLITES & FERMENTED FOOD PRODUCTION

Production of microbial enzymes and its applications, Industrial Bioproducts– microbial synthesis of organic acids (Citric acid, acetic acid.), alcohol (ethanol), antibiotics production (penicillin), Bacteriocins, vitamin(B12) and amino acid(glutamic acid, Tryptophan), Fermented beverages (wine, Beer, Cider) , Fermented food (soy sauce/cheese/Kefir/Sauerkraut), LABs & Fermented Dairy products, Probiotics , single cell proteins.

UNIT III: Agricultural Microbial Technology

Microbial Bio-fertilizers and Biopesticides,Biocontrol, Bioherbicides. Large-scale production of microbial inoculants and Biofertilizer Technology for agriculture.

Unit 4: Environmental Biotechnology

Microbes in bioremediation and biodegradation, Lignocellulosic waste degradation, Microbes in waste water treatment and SWM, microbial ore leaching and mineral recovery, oil recovery, Microbes as alternative energy sources by microbial fuel cells and biofuels. Marine microbial metabolites and biopolymer production

Unit 5: Medical Microbiology

Microbial Pathogenesis, Methods of isolation and detection of pathogenic microorganisms; Biosensors, Production of vaccine, Hormones, antibiotics& AMR.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:**Text:**

- Pelczar, M.J., Chan, E.C.S. & Kreig, N.R. (2001). Microbiology 6th Ed. Tata McGraw Hill.
- Prescott, L.M. (2014). Microbiology, 9th Ed. McGraw by Hill Higher Education.

References:

- Stanier, R.Y., Ingraham, J.L., Wheelis M.L. & Painter, P.R. (2005). General Microbiology, 5th Ed. McMillan,
- Atlas, R.M. (1997). Principles of Microbiology 2nd Ed. WMT Brown Publishers.

- VanDemark, P.J. & Batzing, B.L. Menlo Park (1987). *The microbes: an introduction to their nature and importance*, Benjamin/Cummings Publishing Co.
- Tortora, G. J., Funke, B. R. and Case, C.L. (1994). *Microbiology* 5th Ed. Benjamin Cummings Inc. California.

ADVANCED BIOINFORMATICS**Course Code: MTB103****Credit Unit:03****Theory****Course Objective:**

The course depicts the fundamental concepts and methods in Bioinformatics, a field at the junction of Biology and Computing. The course covers the principles and methods used to search and compare DNA, RNA and proteins, cast as biological "sequences". It also includes three dimensional data of protein structure and the associated problems are structure prediction (secondary and tertiary), analysis of protein structures for clues regarding function, and structural alignment. It serves a gateway course for all science students.

Course Contents:**Module I: Biological databases**

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Structure databases- PDB and MMDB. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

Module II Sequence Analysis

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Scoring Matrices-Pam And Blosum

Gap Penalties, Filtering, Position Specific Scoring Matrices, Internet Resources Tools for Sequence alignment .

Module III Phylogenetic Analysis

Phylogenetic trees: Phylogenetic representations, Definition and description, various types of trees, Methods of phylogenetic analysis: Distance method (UPGMA, The Neighbour Joining, The Fitch/Margoliash method) and Character-based methods (Maximum Parsimony, Maximum Likelihood). Tree evaluation and Comparison of Phylogenetic Trees obtained using DNA seq. Vs. protein seq. Vs. Full genomes. Softwares for phylogenetic analysis

Module IV Insilico Structure prediction of protein and docking

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification databases- CATH and SCOP; structure prediction in proteins- Secondary and Tertiary structure prediction. Structure Visualization tools -RASMOL, PyMoL SWISS-PDB Viewer. Docking of Molecules- Types of Docking and softwares.

Module V EST- Gene Prediction

ESTs – construction, databases, Basics of clustering, application of ESTs, Gene Prediction and Functional classification. Genome Anatomy, Genome Comparison, Genome Analysis, Gene Expression Analysis and databases for profile data. Basics of NGS and its platforms.

Examination Scheme:

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

Text & References:*Text:*

- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley and Sons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience
- Harshawardhan P. Bal, Bioinformatics Principles and Applications, Tata McGraw-Hill Publishing Company Ltd.
- Bioinformatics Basics: Applications in Biological Science and Medicine- Hooman Rashidi, Lukas K. Buehler

References:

- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by Academic Press.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence Analysis, Academic press
- Waterman, M. (1995). Introduction to Computational Biology: Maps, Sequences and Genomes, 1st Ed, Chapman and Hall.

CELLULAR AND MOLECULAR BIOTECHNOLOGY**Course Code: MTB104****Credit Unit:03****Theory****Course Objective:**

The object of the present course is to develop basic knowledge and skills in the Cellular and Molecular Biotechnology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent state-of-the-art technologies. 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. Various applications of Cellular and Molecular Biotechnology in medicine and for sustainable agriculture will also be presented.

Course Contents:**Module I**

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 II

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 Ca²⁺ and diacylglycerol as second messengers.

Module III

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 IV

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

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

Module VI

TAIR and EMBL and their role in bioinformatics analysis of the gene function. Changing landscapes of sequencing technologies (Sanger, Next Generation Sequencing [NGS], and Third-Generation Sequencing (also known as long-read sequencing) for whole genome sequencing of microbes, plants, and animals. Different techniques (DNA Microarrays, RNA Seq, Northern analysis, the GUS reporter system (β -glucuronidase), and quantitative real time PCR [qRT-PCR]) used for detecting and quantifying the expression of the genes (transcripts levels) in response to the growth and development and/or biotic and/or abiotic stresses, functional genomics by forward (Ethyl methane sulphonate [EMS] mutants) and reverse (T-DNA and RNAi-mediated gene silencing) genetic approaches, micro-RNA (miRNA) mediated post-transcriptional regulation of gene expression, post-translational modifications (SUMOylation, phosphorylation, glycosylation, ubiquitination, nitrosylation, and methylation), epistatic gene interactions, molecular basis of epigenetics, applications of the CRISPR-Cas9 system for DNA-free genome editing in plants and animals, and country-specific ethical and social concerns related to the use of Genetically Modified (GM) agronomically important crop species.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Albert, B. (2002). Molecular Biology of the Cell 4th Ed., Garland Science New York.
- Darnell, L. and Baltimore (2012). Molecular Biology, Mac Millan
- Watson et al., (2013). Molecular Biology of the gene, 7th Ed., Pearson.

References:

- Lewis, B. (2003). Genes VIII, Benjamin Cummings.
- Goodenough, U. W. (1984). Genetics 2nd Ed. Saunders (W.B.) Co Ltd.
- Swanson, C. P., Merz, T. & Young, W.J. (1981). Cytogenetics, Prentice Hall
- Berg, J. M., Tymoczko, J. L. & Stryer, L. (2002). Biochemistry, 3rd Ed. W.H. Freeman and Company, ,
- Brown, T.A. (1990). Genomes 2nd Ed. Oxford: Wiley-Liss,

ADVANCED BIOCHEMISTRY AND METABOLIC REGULATION -Lab**Course Code: MTB121****Credit Unit:01****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
 Ammonium Sulfate precipitation, Dialysis of the purified protein solution against 60% glycerol as a demonstration of storage method, Affinity Chromatography

Module II: Nucleic Acid

Biochemical estimation of DNA, RNA. Separation of DNA samples on Agarose gel.

Carbohydrate: Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar

Lipids: Blood Cholesterol estimation.

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

ADVANCED MICROBIAL BIOTECHNOLOGY -Lab**Course Code: MTB122****Credit Unit:01****Course Contents:****Module 1: Basic Microbiological Techniques (Isolation, Identification and Enumeration of Microbes)**

1. Basic and specialized media preparation & Pure culture techniques
2. Isolation, Characterization (Micro, Macro & Biochemical) & Enumeration of microorganisms from soil/air/water: Bacteria, Fungi and Actinomycetes.
3. Anaerobic culture techniques
4. Growth pattern analysis of Bacteria and fungi and Effect of various intrinsic & Extrinsic factors

Module 2: Advanced Microbial Biotechnological Techniques

5. **Agricultural Microbiology:** Isolation of nitrogen fixers (Rhizobium/Azotobacter), PGPR/ PSB/PSF
6. **Environmental Biotechnology:** Estimation of coliforms by MPN in water, Determination of BOD & COD of effluent
7. **Medical Microbiology:** Antibiotic Sensitivity Testing, Identification of food pathogen
8. **Food Microbiology:** Microbiological QA Parameters, Preparation of Fermented food & Beverage (Sauerkraut/ Yogurt/Wine), Organic acid production (Citric acid) by Solid state/ submerged fermentation.

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

ADVANCED BIOINFORMATICS -Lab

Course Code: MTB123

Credit Unit: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		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

CELLULAR AND MOLECULAR BIOTECHNOLOGY -Lab**Course Code: MTB124****Credit Unit:01****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. Sterile and element-contamination-free hydroponic system for the growth of model plant species for studying the stress-mediated spatio-temporal changes in the gene expression.
9. Quantitative real time PCR (qRT-PCR) for the analysis of gene expression.

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: MTB130

Credit Unit:03

Theory

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.

Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Wilson, K. & Walker, J. (2000). Practical Biochemistry, Principles & Techniques 5th Ed. Cambridge University Press.
- Friefelder, D. (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology 2nd Ed. W. H. Freeman

References:

- Hoppert, M. (2005). Microscopic Techniques in Biotechnology, Wiley-Blackwell.
- Venn, R. F. (2002). Principles and Practice of Bioanalysis 1st Ed. Taylor and Francis, London.
- Van Impe, J.F.M., Vanrolleghem, P. A. & Iserentant, D. M. (1998). Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, Springer Science + Business media
- Glusker, J.P. & Trueblood, K.N. (1985). Crystal Structure Analysis: a primer by Oxford University Press.
- Rhodes, G. (1993). Crystallography Made Crystal Clear: A Guide for Users of Macromolecular Models, Academic Press Inc.
- Gunter, H. (1992). NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, Wiley India Pvt. Limited.
- Van Holde, K. E., Johnson, W. C. & Ho, P. S. (2006). Principles of Physical Biochemistry” by Prentice Hall

IPR & DRUG REGULATORY AFFAIRS**Course Code: MTB131****Credit Unit:03****Theory:****Course Objective:**

It will familiarize the students of the IPR issues and regulatory issues pertaining to health care industries. The unit will also cover the regulatory legislation and associated approvals and permissions required to conduct high-quality single-centre, national and international clinical trials.. Ethical issues will be considered throughout the unit.

Module-I (Intellectual Property Rights-I)

Regulatory affairs and its importance.

General Principles of Intellectual Property: Copyright, Trademark, Inventions-Patentable, Geographical Indications, Industrial Designs, Integrated Circuits, Trade Secrets. Patents: need of patents, major types of patents, International registration of patents, patent term and extension The Patents Act, 1970 – Salient features.

Module-II (Intellectual Property Rights-II)

Organization: Intellectual Property Rights, World Trade Organization (WTO), World Intellectual Property Organization (WIPO), Paris Convention, Berne Convention, TRIPS Agreement, the Doha Declaration, Patent Cooperation Treaty (PCT), Madrid Protocol.

Module-III (Drug Regulatory Affairs-I)

New Drug Application: Steps involved in the development of new drug. New drug applications as per WHO guidelines and abbreviated NDA. Requirement and guidelines on clinical trials, Investigational New Drug Application (IND).

Module-IV (Drug Regulatory Affairs-II)

Generic Drug Products: Drug Regulations – IND and NDA, Drug Regulations – ANDA, Generic Drug Product Development, Generic Drug Product Approval, SUPAC.

Introduction about GMP, cGMP, GLP, GCP, CDSCO, CPCSEA, US-FDA

Module-V (Drug and Cosmetic Act)

Introductory drugs Jurisprudence: Drugs & Cosmetic Act & Rules

Evaluation:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Texts & References

1. Dr. N.S. Vyawahare and Sachin Itkar, (2011). Drug Regulatory Affairs, Nirali Prakashan
2. C.V.S. Subrahmanyam & J. ThimmaSetty, (2012). Pharmaceutical Regulatory Affairs, Vallabh Prakashan
3. Quality Assurance of Pharmaceutics Vol I & II (1999).WHO publications
4. WIPO website study material
5. Nair, Kanakkan Raghavan Gangadharan, and Ashok Kumar, (1994), Intellectual property rights. No. 1. Allied Publishers.
6. Cell, I. P. R. (2002), "Intellectual property rights."
7. Yan, Huang. (1996), "Intellectual property rights."

INDUSTRIAL SAFETY AND HAZARDS**Course Code: MTB132****Credit Unit:03****Theory****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. Workmen - compensation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:**Text:**

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Association. Van Nostrand Reinhold Company, New York.
- Anonymous (1972). Guide for Safety in the Chemical Laboratory, 2nd Ed., Van Nostrand Reinhold Co., Litton Educational Publishing, Inc., New York
- Fawcett, H.H. & Wood, W.S. (1982). Safety and Accident Prevention in Chemical Operation, 2nd Ed. John Wiley and sons, New York.

References:

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

COMMUNICATION SKILLS – I**Course Code:** BCS 111**Credit Unit:**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

Behavioural Science-I (Self Development and Interpersonal Skills)

Course Code: BSS111

Credit Unit: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:** FLT 111**Credit Unit:**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

GERMAN – I**Course Code:** FLG 111**Credit Unit:**02**Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Course Contents:**Module I: Introduction**

Self introduction: heissen, kommen, wohnwn, lernen, arbeiten, trinken, etc.

All personal pronouns in relation to the verbs taught so far.

Greetings: Guten Morgen!, Guten Tag!, Guten Abend!, Gute Nacht!, Danke sehr!, Danke!, Vielen Dank!, (es tut mir Leid!),

Hallo, wie geht's?: Danke gut!, sehr gut!, prima!, ausgezeichnet!,

Es geht!, nicht so gut!, so la la!, miserabel!

Module II: Interviewspiel

To assimilate the vocabulary learnt so far and to apply the words and phrases in short dialogues in an interview – game for self introduction.

Module III: Phonetics

Sound system of the language with special stress on Diphthongs

Module IV: Countries, nationalities and their languages

To make the students acquainted with the most widely used country names, their nationalitie and the language spoken in that country.

Module V: Articles

The definite and indefinite articles in masculine, feminine and neuter gender. All Vegetables, Fruits, Animals, Furniture, Eatables, modes of Transport

Module VI: Professions

To acquaint the students with professions in both the genders with the help of the verb “sein”.

Module VII: Pronouns

Simple possessive pronouns, the use of my, your, etc.

The family members, family Tree with the help of the verb “to have”

Module VIII: Colours

All the color and color related vocabulary – colored, colorful, colorless, pale, light, dark, etc.

Module IX: Numbers and calculations – verb “kosten”

The counting, plural structures and simple calculation like addition, subtraction, multiplication and division to test the knowledge of numbers.

“Wie viel kostet das?”

Module X: Revision list of Question pronouns

W – Questions like who, what, where, when, which, how, how many, how much, etc.

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:

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

SPANISH – I**Course Code:** FLS 111**Credit Unit:**02**Course Objective:**

To enable students acquire the relevance of the Spanish language in today's global context, how to greet each other. How to present / introduce each other using basic verbs and vocabulary

Course Contents:**Module I**

A brief history of Spain, Latin America, the language, the culture...and the relevance of Spanish language in today's global context.

Introduction to alphabets

Module II

Introduction to '*Saludos*' (How to greet each other. How to present / introduce each other).

Goodbyes (*despedidas*)

The verb *llamarse* and practice of it.

Module III

Concept of Gender and Number

Months of the years, days of the week, seasons. Introduction to numbers 1-100, Colors, Revision of numbers and introduction to ordinal numbers.

Module IV

Introduction to *SER* and *ESTAR* (both of which mean To Be).Revision of '*Saludos*' and '*Llamarse*'. Some adjectives, nationalities, professions, physical/geographical location, the fact that spanish adjectives have to agree with gender and number of their nouns. Exercises highlighting usage of *Ser* and *Estar*.

Module V

Time, demonstrative pronoun (*Este/esta, Aquel/aquella* etc)

Module VI

Introduction to some key AR /ER/IR ending regular verbs.

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:

- Español, En Directo I A
- Español Sin Fronteras

CHINESE – I**Course Code:** FLC 111**Credit Unit:**02**Course Objective:**

There are many dialects spoken in China, but the language which will help you through wherever you go is Mandarin, or Putonghua, as it is called in Chinese. The most widely spoken forms of Chinese are Mandarin, Cantonese, Gan, Hakka, Min, Wu and Xiang. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

Course Contents:**Module I**

Show pictures, dialogue and retell.

Getting to know each other.

Practicing chart with Initials and Finals. (CHART – The Chinese Phonetic Alphabet Called “Hanyu Pinyin” in Mandarin Chinese.)

Practicing of Tones as it is a tonal language.

Changes in 3rd tone and Neutral Tone.

Module II

Greetings

Let me Introduce

The modal particle “ne”.

Use of Please ‘qing’ – sit, have tea etc.

A brief self introduction – Ni hao ma? Zaijian!

Use of “bu” negative.

Module III

Attributives showing possession

How is your Health? Thank you

Where are you from?

A few Professions like – Engineer, Businessman, Doctor, Teacher, Worker.

Are you busy with your work?

May I know your name?

Module IV

Use of “How many” – People in your family?

Use of “zhe” and “na”.

Use of interrogative particle “shenme”, “shui”, “ma” and “nar”.

How to make interrogative sentences ending with “ma”.

Structural particle “de”.

Use of “Nin” when and where to use and with whom. Use of guixing.

Use of verb “zuo” and how to make sentences with it.

Module V

Family structure and Relations.

Use of “you” – “mei you”.

Measure words

Days and Weekdays.

Numbers.

Maps, different languages and Countries.

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:

- “Elementary Chinese Reader Part I” Lesson 1-10

GOOD LABORATORY PRACTICES

Course Code: NCC001**Duration: 30 hrs****Credit: Non Credit**

Objective: Good Laboratory Practices (GLP) are so important to modern laboratory operations, this course will incorporate many of the principles that are part of GLP in contemporary commercial laboratories. It will be useful for the graduate's individuals seeking careers in the industry(food, agriculture, pharmaceutical, clinical, biotech, cosmetics, environmental, etc.)who need practical skills and expertise for the food, pharmaceutical, biotechnology and healthcare workforce.

Course Contents:**Introduction to GLP**

Good laboratory practices-Introduction, WHO guidelines on GLP and GMP

History of Good Laboratory Practices

Quality assurances in Good Laboratory Practices, Including SOP, Log Books, Stock register

Quality Standards and Quality Assurances

Quality Standards- Advantages and Disadvantages, Concept of Quality Control

Quality Assurance- Their functions and advantages

Quality assurance and quality management in industry

Customer requirement of quality

Government and trade standards of quality Federal Food and Drug Law FDA Action BSTI

Laws, BSTI action and activities Other food laws (Legalization)

Trade and Company Standards Control by National, International, Social Organizations

(example:FAO, WHO, UNICEF, CAB), Society (example: NSB, Professional societies)

Good Manufacturing Practices in Pharmaceutical and Food Industries

Types of validation in Pharma industry

Scope and importance of Validation

Organization and Elements of validation (Q, OQ, PQ and DQ) Cleaning Validation

Validation of Analytical Procedures as per ICH Guidelines Implications of cGMP and Food plant sanitation

The regulations of cGMPs Planning of Plant Sanitation Programs and Construction factors

Hygeinic design of food plants and equipments Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials Control of rats, rodents, birds, insects and microbes.

Cleaning and Disinfection: Physical and Microbiological Approach

Biosafety & Hazards

Introduction: Historical Background, Biosafety in Laboratory/ institution.

Laboratory associated infections and other hazards

Assessment of Biological Hazards and levels of biosafety

Prudent biosafety practices in the laboratory/institution Introduction to Biological safety cabinets

Primary Containment of Biohazards, Biosafety Levels

Recommended Biosafety Levels for Infectious Agents and Infected Animals Biosafet guidelines

Government of India Guidelines, Definition of Genetically Modified Organisms (GMOs)

Examination Scheme:

Criteria	Assignment	Case Study	Presentation
Grade	Pass/ Not Pass		

Text Book:

1. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series
2. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results, By Al Endres, Wiley, 2000
3. Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, By Jiju Antony; David Preece, Routledge, 2002
4. The Quality Management Sourcebook: An International Guide to Materials and Resources By Christine Avery; Diane Zabel, Routledge, 1997
5. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.
6. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol.69, Marcel Dekker Series, 1995.

ENZYMOLGY AND PROTEIN ENGINEERING

Course Code: MTB201

Credit Units:03

Course Contents:

Module I: Enzymes

Introduction, Nomenclature, Mechanism of Catalysis, Catalysis in organic media, Enzyme regulation, Allosteric enzymes

Module II : Enzyme Kinetics

Enzyme kinetics, Thermodynamics of enzyme reactions, Enzyme inhibition. Multisubstrate reaction

Module III: Immobilization

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

Module IV: Protein Engineering

Protein engineering of enzyme : Rational and directed evolution , Mutational effect on engineered proteins, Engineered proteins; Structure function design for protein design

Module V:

Enzyme expression systems

Protein expression in bacterial, mammalian, insect systems. Biotransformations, Concept of bioreactors

Biotechnological applications of enzymes

Enzyme utilization in industry, Ribozymes, Abzymes, Inteins, Cold adapted enzymes.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Enzymology T. Devasena (2010) Oxford publications
- Protein Engineering: Principles and Practice 1st Edition Jeffrey L. Cleland and Charles S. Craik
- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- **Protein Engineering: Technology and Application** (2013) Tomohisa Ogawa InTech Open
- Protein Engineering and Design Sheldon J. Park, Jennifer R. Cochran 2009 CRC Press

References:

- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Enzyme Kinetics: Behavior 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

BIOPROCESS AND FERMENTATION TECHNOLOGY

Course Code: MTB202

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 sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of Industrial Media, Air and Fermenter

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 etc.

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: B₁₂, 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. po wer 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, penicillanase, 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.

Module V 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	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

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, Bailey and Ollis.
- Principles of Biochemical Engineering, Humphrey.

ADVANCED IMMUNOTECHNOLOGY

Course Code: MTB203

Credit Units:03

Course Objective:

Role of antibody engineering in biomedical applications and the importance of immunogenetics 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

Concept of immunity- Innate and acquired, Active and Passive immunity, Cell mediated and Humoral immunity, Primary and secondary immune response, Clonal nature of Immune Response.

Module II:

Immune system: Central and peripheral immune system

Primary lymphoid organs: Thymus and Bone marrow, T and B cell development

Secondary lymphoid organs: Spleen, lymphnode and MALT

Ectopic lymphoid tissues

Hematopoiesis, Cells of the immune system- Eosinophils, Neutrophils, Basophils, B and T-lymphocytes, macrophages, Null cells, dendritic cells, Mast cells.

Receptors: BCR and TCR, Fc receptor

Module III:

Nature and biology of Antigen: Immunogen vs. Antigen, factors affecting immunogenicity, Hapten and carriers, Adjuvants, Super antigens

Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Monoclonal antibodies: production and applications, Generation of antibody diversity,

Module IV

MHC: Structure of MHC class I, II & III, exogenous and endogenous antigen presentation by MHC, MHC restriction, Self-tolerance in relation to MHC.

Autoimmunity and autoimmune diseases, Role of MHC in autoimmune diseases

Transplantation immunology, immunosuppressive therapy, tissue typing, immunologically privileged sites.

Module V

Complement system

Vaccines

Tumor immunology

Concept of inflammation and hypersensitivity

Antigen - antibody interaction based diagnostics: agglutination and precipitation, ELISA, RIA, IFA

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

Owen J., Punt J., and Stranford Sharon (2013): Kuby's Immunology, 7th Edition, Macmillan higher education, New York. ISBN-13: 978-1-4292-1919-8.

Delves P., Martin S., Burton D. and Roitt I.(2006): Roitt's Essential Immunology, 11th Edition, Blackwell Publishers, Oxford.

References:

• Abbas AK, Lichtman AH, Pillai S (2010) Cellular and Molecular Immunology, 6th Edition, Saunders Elsevier, ISBN:978-0-8089-2411-1

ADVANCED BIOSTATISTICS FOR BIOLOGISTS

Course Code: MTB204

Credit Units:03

Theory:

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,

Module IV: Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

Module V: Applications of statistical methods using statistical software

Evaluation:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

- Wayne. W Daniel (1987). Biostatistics: A foundation for analysis in the Health Sciences, John Wiley and Son
- P.N. Arora (2007). Comprehensive Statistical methods, S. Chand Limited

RESEARCH METHODOLOGY AND SCIENTIFIC WRITING

Course Code: MTB205

Credit Units:03

Theory

Course Objective:

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

Course Contents:

Module I

Introduction: Science, Scientific Field and Biological research. Role of a researcher in different stages of a project, Routes to research funding (academic and commercial)

Module II

Research – Definition – Importance and Meaning of research – Characteristics of research – Types of Research – Steps in research – Identification, Selection and formulation of research problem – Research questions – Research design – Formulation of Hypothesis – Review of Literature.

Module III: Sampling techniques

Sampling theory – types of sampling – Steps in sampling – Sampling and Non-sampling error – Sample size – Advantages and limitations of sampling. Collection of Data: Primary Data – Meaning – Data Collection methods – Secondary data – Meaning - Relevance's, Limitations and cautions. Statistics in Research.

Module IV

Type of Articles (review, letters etc). Scientific paper format (Abstract, Introduction, Materials and Methods, Results, Discussion). Writing, evaluating, presenting and publishing the results of scientific research in the academic press (journals, conferences etc). Choosing the appropriate journal (Sources, Information, Instructions to authors, peer review system, journal evaluation)

Module V

Case studies of areas of current research. Formulating a research plan and its presentation

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Statistical Methods By S.P. Gupta

References:

- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta
- Scientific journals and magazines

ENZYMOLGY AND PROTEIN ENGINEERING -Lab**Course Code: MTB221****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.

1. Purification of Enzyme by ammonium sulphate fractionation.
2. Effect of Temperature and pH on enzyme activity.
3. Plot of enzyme kinetic graphs
4. Enzyme immobilization
5. Cloning and expression of protein
6. Effect of mutation on protein: In silico studies

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

BIOPROCESS AND FERMENTATION TECHNOLOGY -Lab
Course Code: MTB222 **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 Kraut fermentation

Module VIII

Use of alginate for cell immobilization

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

ADVANCED IMMUNOTECHNOLOGY -Lab**Course Code: MTB223****Credit Units:01****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, Differential leucocyte count, Total leucocyte count, preparation of serum and plasma.

Module II

Lymphoid organs and their location in mice

Module III

Ouchterlony Double diffusion Test, Immunoelectrophoresis, ELISA:- DOT or SANDWICH

Module IV

Purification of IgG through affinity chromatography

Module V

Agglutination based tests: WIDAL Test, Identification of blood group

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: MTB230

Credit Units:03

Theory

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 N₂ - 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.
 Principles in ecotoxicology; animal toxicity tests; statistical concepts of LD₅₀; 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; EC₅₀;

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

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

MEDICAL BIOTECHNOLOGY**Course Code: MTB231****Credit Units:03****Theory****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 bacteria, Staphylococci, Streptococci etc. Isolation and identification strategies of bacteria. Etiology-identification of disease agents and their source, transmission, portals of entry, nosocomial infections. 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, (cancer /diabetts) transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module V Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases- public health control methods. Hygiene regulations, population screening for disease. Management of Clinical Data.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

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.

PHARMACEUTICAL TECHNOLOGY and BIOTECHNOLOGY

Course Code: MTB232

Credit Units:03

Theory:

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

Pharmaceutical Technology:

Module –I:

Introduction to Physical Pharmaceutics – Metrology, Calculations and Posology.

Pharmacopoeias & Formularies: IP,BP,USP

Packaging of Pharmaceuticals: Polymer Science and Applications, Formulations and Development, Packaging

Particulate Technology: Particle Size, Size reduction, Size Separation, Powder Flow and Compaction

Unit Operations: Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, Sterilization, and Drying

Module-II

Pharmaceutical Dosage Forms & New Drug Delivery Systems:

Introduction to different dosage forms, their classification with examples (Official formulation), their relative application. Various route of drug administration.

Drug delivery systems: transdermal, parenteral, oral, mucosal, ocular, buccal, rectal and pulmonary delivery. Novel formulation approaches for better delivery of biotechnology derived drugs, such as reverse micelles, liposomes, microemulsions and microencapsulation.

Pharmaceutical Biotechnology:

Module III

Immunity & Immunological preparations.

Introduction about Immunity, Types of Immunity, Immunological preparations, Classification of Immunological preparations, Bacterial & Viral Vaccines, Method of preparation using animals, Alternative method using eggs, Diagnostic preparations containing bacterial toxins, Preparation containing antibodies used to produce passive immunity.

Blood & blood Products:

Module-IV

Blood Products and Plasma Substitutes: Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, fibrin foam, plasma substitutes: ideal requirements, PVP, dextran.

Module-V

Pharmaceutical Biotechnology based drug Products:

Introduction, Method of Preparation and Use of :Activase, Humulin,Streptokinase Humatrope, Hepatitis B vaccine.

Introduction, Method of Preparation and Use of : Penicillins, streptomycins, tetracyclines, vitamin B12 & ethanol.

Evaluation:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

- Daan J. A. Crommelin and Robert D. Sindelar, (2014). Pharmaceutical Biotechnology, 3rd Ed. Informa Healthcare USA, Inc.
- Chandrakant Kokate, Pramod H.J and S.S. Jalalpure, (2012). Textbook of Pharmaceutical Biotechnology, Elsevier Health Sciences.
- Vyas S.P and Dixit V.K. (2007) Pharmaceutical Biotechnology 1stEd.CBS Publishers & Distributors.

COMMUNICATION SKILLS - II

Course Code: BCS 211

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 Science – II
(Behavioral Communication and Relationship Management)
 Course Code: BSS211 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: FLT 211

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

GERMAN – II**Course Code:** FLG 211**Credit Units:**02**Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Grammar to consolidate the language base learnt in Semester I

Course Contents:**Module I: Everything about Time and Time periods**

Time and times of the day.

Weekdays, months, seasons.

Adverbs of time and time related prepositions

Module II: Irregular verbs

Introduction to irregular verbs like to be, and others, to learn the conjugations of the same, (fahren, essen, lessen, schlafen, sprechen und ähnliche).

Module III: Separable verbs

To comprehend the change in meaning that the verbs undergo when used as such

Treatment of such verbs with separable prefixes

Module IV: Reading and comprehension

Reading and deciphering railway schedules/school time table

Usage of separable verbs in the above context

Module V: Accusative case

Accusative case with the relevant articles

Introduction to 2 different kinds of sentences – Nominative and Accusative

Module VI: Accusative personal pronouns

Nominative and accusative in comparison

Emphasizing on the universal applicability of the pronouns to both persons and objects

Module VII: Accusative prepositions

Accusative prepositions with their use

Both theoretical and figurative use

Module VIII: Dialogues

Dialogue reading: ‘In the market place’

‘At the Hotel’

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:

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

SPANISH – II**Course Code:** FLS 211**Credit Units:**02**Course Objective:**

To enable students acquire more vocabulary, grammar, Verbal Phrases to understand simple texts and start describing any person or object in Simple Present Tense.

Course Contents:**Module I**

Revision of earlier modules.

Module II

Some more AR/ER/IR verbs. Introduction to root changing and irregular AR/ER/IR ending verbs

Module III

More verbal phrases (eg, Dios Mio, Que lastima etc), adverbs (*bueno/malo, muy, mucho, bastante, poco*). Simple texts based on grammar and vocabulary done in earlier modules.

Module IV

Possessive pronouns

Module V

Writing/speaking essays like my friend, my house, my school/institution, myself....descriptions of people, objects etc, computer/internet related vocabulary

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:

- Español, En Directo I A
- Español Sin Fronteras

CHINESE – II**Course Code:** FLC 211**Credit Units:**02**Course Objective:**

Chinese is a tonal language where each syllable in isolation has its definite tone (flat, falling, rising and rising/falling), and same syllables with different tones mean different things. When you say, “ma” with a third tone, it mean horse and “ma” with the first tone is Mother. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

Course Contents:**Module I**

Drills

Practice reading aloud

Observe Picture and answer the question.

Tone practice.

Practice using the language both by speaking and by taking notes.

Introduction of basic sentence patterns.

Measure words.

Glad to meet you.

Module II

Where do you live?

Learning different colors.

Tones of “bu”

Buying things and how muchit costs?

Dialogue on change of Money.

More sentence patterns on Days and Weekdays.

How to tell time. Saying the units of time in Chinese. Learning to say useful phrases like – 8:00, 11:25, 10:30 P.M. everyday, afternoon, evening, night, morning 3:58, one hour, to begin, to end etc.

Morning, Afternoon, Evening, Night.

Module III

Use of words of location like-li, wais hang, xia

Furniture – table, chair, bed, bookshelf,.. etc.

Description of room, house or hostel room.. eg what is placed where and how many things are there in it?

Review Lessons – Preview Lessons.

Expression ‘yao’, ‘xiang’ and ‘yaoshi’ (if).

Days of week, months in a year etc.

I am learning Chinese. Is Chinese difficult?

Module IV

Counting from 1-1000

Use of “chang-chang”.

Making an Inquiry – What time is it now? Where is the Post Office?

Days of the week. Months in a year.

Use of Preposition – “zai”, “gen”.

Use of interrogative pronoun – “duoshao” and “ji”.

“Whose”??? Sweater etc is it?

Different Games and going out for exercise in the morning.

Module V

The verb “qu”

Going to the library issuing a book from the library

Going to the cinema hall, buying tickets

Going to the post office, buying stamps

Going to the market to buy things.. etc

Going to the buy clothes Etc.

Hobby. I also like swimming.

Comprehension and answer questions based on it.

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:

- “Elementary Chinese Reader Part I” Lesson 11-20

BIOPROCESS PLANT DESIGN

Course Code: MTB301

Credit Units: 03

Course Objective:

The Objective of this paper is to include not only application of chemical engineering principles/ unit operation to bioprocess system 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.

Module II

Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application.

Module III

Design of bioreactors; 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

Module IV

Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology production plants; Process economics

Module V

Bioprocess validation; Safety Considerations; Case studies.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Process Plan Layout and Piping Design, E. Bausbacher, R. Hunt, Prentice Hall PTR.
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth- Heinemann.
- Applied Process design for Chemical and Petrochemical Plants, E. E. Ludwig, Butterworth- Heinemann.

References:

- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw- Hill.
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus.

DOWNSTREAM PROCESSING

Course Code: MTB 302

Credit Units:03

Course Objective:

The syllabus will help the students to characterize the Bioproducts of biotechnological importance and to get expertise in their downstream processing.

Course Contents:

Module I

Characteristics of Bioproducts, Conditioning of broth, Mechanical separation, Filtration, Centrifugation, Cell disruption techniques, Protein precipitation and separation.

Module II

Aqueous - two-phase extraction; Adsorption-desorption processes; Membrane based separation: Dialysis, Electro dialysis, Micro filtration, Ultra filtration.

Module III

Chromatographic methods of separation based on size, charge, reverse phase, hydrophobic interactions, and biological affinity, HPLC, FPLC, MS-LC, Gas chromatography.

Module IV

Electrophoresis, principle, types on the basis of support media, 1D, 2D gel electrophoresis, continuous and capillary electrophoresis.

Module V

Crystallization, Drying, Case studies.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Bioseparations: Downstream Processing for Biotechnology, P.A. Belter et al, John Wiley and Sons Inc.

References:

- Practical Biochemistry, Principles & Techniques, Keith Wilson and John Walker
- Bioseparations: Principles and Techniques, Sivasankar, Prentice-Hall
- Biochemical Engineering Fundamentals, J.E. Bailey and D.F. Ollis, McGraw-Hill
- 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. Wilson, C.C. Painton and S.E. Builder, American Chemical Society

NANOBIOTECHNOLOGY**Course Code: MTB 303****Credit Units:03**

Course objective: Nanotechnology is one of the most important and influential fields in today's scenario. It holds tremendous potential and have shown significant impact on both basic and applied sciences. The major objective of this course is to introduce this contemporary area to the students so that they can apply their knowledge to develop new applications in the field of biomedicine.

Course contents**Module I: Introduction to Nanotechnology**

Overview of nanotechnology developments, different nanostructured materials, various rules governing the health and safety standards related to the use of chemicals and nanomaterials, the physical environment required for working with nanomaterials.

Module II: Investigation and manipulation of nanomaterials

Construction, working principle and applications of electron microscopies, scanning probe microscopies, optical microscopies, Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy and X-ray diffraction for nanosciences and technology.

Module III: Nanostructures for medicinal applications

Overview of nanobiotechnology and nanomedicine with future perspectives. Biological barriers to nanocarrier-mediated delivery of therapeutic and imaging agents, nanoparticle contrast agents for molecular magnetic resonance imaging, micro- and nanoscale control of cellular environment for tissue engineering. Nanotechnology in cancer.

Module IV: Societal implications of Nanoscience

From the first industrial revolution to the nano revolution, implications of Nanoscience and nanotechnology on Society, Nano policies, Nano arms race, public perception and public involvement in the nano discourse, Harnessing nanotechnology for economic and social development.

Module V: Nanomaterials and Toxicity

Toxicity – nanoparticles in the environment – Health threats- nanomaterials and biotoxicity –Iron oxide – Titanium dioxide-dark studies –UV irradiation- In vivo - In Vitro and cytotoxicity studies.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Books:

- Nanobiotechnology: Concepts, Applications and Perspectives by Christof M. Niemeyer and Chad A. Mirkin, First Wiley 2006, ISBN: 978-3-527-60591-0.
- Nanobiotechnology II: More Concepts and Applications by Chad A. Mirkin and Christof M. Niemeyer, Wiley 2007, ISBN: 978-3-527-31673-1.
- Nano: The essentials - Understanding the nanoscience and technology by T. Pradeep, Tata McGraw-Hill Publishing Company Limited 2008, ISBN-10:0-07-154829-7 / 0071548297.

RECOMBINANT DNA TECHNOLOGY

Course Code: MTB 304

Credit Units:03

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

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	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

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

References:

- 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.

GENOMICS AND PROTEOMICS

Course Code: MTB 305

Credit Units: 02

Course Objective:

The course helps in developing a detailed understanding of eukaryotic 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

Contents of genomes, Molecular markers, Bioinformatics for the analysis of sequence data.

Module II: Transcriptomes

Genome expression; RNA Contents,

Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The human genome project. Human disease genes.

PROTEOMICS

Module III: 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 solute. The activity of protein. Protein engineering principles.

Module IV

Fundamental methods used in proteomics, Relationship between protein structure and function. Post translational protein modification. Protein - protein interaction.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

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.
- Gene cloning and DNA analysis – An introduction (fourth edition), T.A. Brown.

DOWNSTREAM PROCESSING LAB

Course Code: MTB 322

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		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

NANOBIOTECHNOLOGY LAB**Course Code: MTB 323****Credit units : 1**

1. Demonstration about occupational health and safety (OHS) or workplace health and safety (WHS) in nanotechnology.
2. Preparation of aqua regia, its handling and role in washing glass-wares for metal nanoparticles synthesis.
3. Surface plasmon resonance (SPR) properties of silver nanoparticles synthesised by plant extracts.
4. Optimization of temperature for metal nanoparticles preparation using biological molecules.
5. Investigation of UV-Vis spectroscopic feature of metal nanoparticles developed after temperature optimization.
6. Construction of bimetallic nanoparticles and their studies on their optical properties.
7. Interaction of nanoparticles with biological cells (Haemolysis or antimicrobial potential of metal nanoparticles).
8. Preparation of polymeric film for nanomedicine applications.
9. Functionalization of nanoparticles with drug or fluorescent molecules and confirmation of functionalization.

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

RECOMBINANT DNA TECHNOLOGY LAB**Course Code: MTB 324****Credit Units: 01****Course Contents:**

1. Preparation and Transformation of competent cells by CaCl₂ method.
2. Restriction digestion
3. Ligation
4. Southern hybridization
5. Western blotting
6. RFLP
7. PCR

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

GENOMICS AND PROTEOMICS LAB**Course Code: MTB 325****Credit Units: 01****Course Contents:**

1. Gene finding tools and Genome annotation
2. Comparison of two given genomes
3. Micro array and Micro array data analysis
4. Inference of protein function from structure
5. Two-hybrid methods

Examination Scheme:

IA				EE		
Practical (Mid Term)	Viva	Regular Performance	Attendance	Practical (End Term)	Practical Record	Viva
20	15	10	05	25	10	15

Note: Minor variation could be there depending on the examiner.

ADVANCED FOOD TECHNOLOGY

Course Code: MTB 330

Credit Units: 03

Course Objective:

The purpose of the food biotechnology major is to produce professional 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 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

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 III

Development of environment - friendly packaging materials based on product characteristic and performance properties packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminum containers, and retortable pouches based on heat penetration studies and sterilization value.

Module IV

Starter culture, prebiotics, probiotics - their use as flavor enhancer and diseases/ infection combats, application in production of cheese, butter, ice-cream, yoghurt, application in biomedical research, e.g. recombinant LABs as vaccine; modified milk proteins.

Module V

Production of SCP (Single cell protein), baker's yeast, brewing industry, application of transgenic plants in food production, transgenic fish, transgenic poultry.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Food technology by Frazier.
- Food Microbiology, 2nd edition by Adams and Moss.

References:

- Introduction to food Biotechnology. Green, Perry Johnson 2002. CRC Press, Boca Raton Florida.
- Food Biotechnology- Techniques and application. Gauri S. Mittal 1992. Technomic Publishing Co., Inc., Lancaster.

TISSUE ENGINEERING

Course Code: MTB 331

Credit Units:03

Course Objective:

This course will cover topics related to the design and functional assessment of bioengineered tissue substitutes. Strategies for engineering tissues with a load-bearing function will be of particular focus. Strategies to study cell-surface and cell-cell interactions to physical stimuli, bioreactors, biological scaffolds and 3D cell-tissue constructs will be explored through recent papers.

Course Contents:

Module I: Fundamentals of tissue engineering

Basic definition, History, Concepts and overview, Principles and components, current scope of development; use in therapeutics and in vitro testing

Module II: Engineering materials

Scaffolds: Functions, Types (ECM-like Scaffolds, Tissue-Derived Scaffolds, Fibrin Gel, Natural Sponge; Injectable Scaffolds, Elastic Scaffolds, Inorganic Scaffolds Composite Scaffolds). Biomaterials: properties, cellular adhesion, surface modifications. Polymers (Natural such as Protein and Polysaccharides; Synthetic such as Poly(α -hydroxyacids, Hydrogels and Polyurethanes), Composite.

Module III: Cell Sources:

Fundamental properties of cells, autologous, allogeneic, syngeneic, and xenogeneic cells, and genetically engineered cells, Stem and progenitor cells. Cell Extraction, Biomolecules /synthetic ECM: Growth Factors (Representative Growth factors), Delivery of Growth factors

Module IV: Tissue Culture & Engineering Design Aspects

Biomechanics aspects of tissue engineering: application of physical forces, Principles of Scaffold Design – Material considerations, 2 D cell expansion, 3D Tissue Architecture and Function Transport considerations, Bioreactors, Cell seeding and metabolism considerations, Design of Polymeric Scaffolds, Interface Biology – Biocompatibility/Immunogenicity.

Module V: Case Studies

Musculoskeletal Tissue Engineering, Cardiovascular Tissue Engineering, Neural Tissue Engineering, Visceral Tissue Engineering. Other Key Issues and Emerging Areas of Interest: Nanobiotechnology, Ethical Issues, FDA and Regulatory Issues, Tissue Engineering Market

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Frontiers in Tissue Engineering (ISBN 0080426891), Patrick, Mikos, McIntire, Pergamon
- Principles of Tissue Engineering (ISBN 0124366309), Lanza, Langer, Vacanti, Academic Press

References:

- **Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues** By W. Mark Saltzman; Published Oxford University Press US, 2004, pp 523
- Tissue engineering Fundamentals and Applications By Yoshito Ikada, Published Elsevier, 2006, pp 469
- Tissue Engineering Methods & Protocols (ISBN 0896035166, Morgan and Yarmush, Humana Press.

DRUG DISCOVERY & DEVELOPMENT**Course Code: MTB 332****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 discovery & development:**

General Introduction of drug design and development, Strategies for Target Identification and validation, Lead Identification and Optimization, Pre-Clinical Research and Clinical Research & Pharmacovigilance.

Module: II**Drug development considerations:**

Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics.

Module: III**Pharmacokinetics:**

Pharmacokinetic, Pharmacodynamic and Toxicological considerations in drug development, Physicochemical properties of drugs in relations to their biological activity, Rout of drugs administrations, Various types of dosage formulations, Stability of drugs.

Module: IV**Drug Receptor Theories:**

Principles of drug action, Mechanisms of drug action, Drug-receptor interactions, Types of drug targets, G-Protein coupled receptor, Ion Channels, Ligand Gated Ion Channels, Enzymatic drug receptor and Transducer mechanisms, Dose response relationship, Factors modifying drug action.

Module: V**Rational Drug Design:**

Introduction, Types of drugs design: Legand based, Structure based, Rational drug discovery, Computer Aided drug design, De novo drug design methodologies.

Structure activity relationships in drug design, Statistical techniques behind QSAR, Molecular descriptors 3D QSAR and COMFA, Molecular modeling, Molecular docking and dynamics.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Suggested Books:

- New Drug Development: Design, Methodology, and Analysis, by J. Rick Turner, Published by John Wiley & Sons, 2007.
- Essentials of Medical Pharmacology by K D Tripathi, Published by JAYPEE Brothers Medical Publishers (P) Ltd. 7th Edition 2010.
- Biopharmaceutics & Pharmacokinetics by DM Brahmankar & SB Jaiswal, Published by Vallabh Prakashan; 3rd Edition 2012.
- Drug Discovery and Clinical Research, by S.K Gupta, Published by JAYPEE Brothers Medical Publishers (P) Ltd

COMMUNICATION SKILLS - III

Course Code: BCS311

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.

Behavioral Science III (Leading Through Teams)

Course Code: BSS311

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 Self Development and Interpersonal Skills, 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: FLT311

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

GERMAN - III**Course Code: FLG311****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Course Contents:**Module I: Modal verbs**

Modal verbs with conjugations and usage

Imparting the finer nuances of the language

Module II: Information about Germany (ongoing)

Information about Germany in the form of presentations or "Referat" – neighbors, states and capitals, important cities and towns and characteristic features of the same, and also a few other topics related to Germany.

Module III: Dative case

Dative case, comparison with accusative case

Dative case with the relevant articles

Introduction to 3 different kinds of sentences – nominative, accusative and dative

Module IV: Dative personal pronouns

Nominative, accusative and dative pronouns in comparison

Module V: Dative prepositions

Dative preposition with their usage both theoretical and figurative use

Module VI: Dialogues

In the Restaurant,

At the Tourist Information Office,

A telephone conversation

Module VII: Directions

Names of the directions

Asking and telling the directions with the help of a roadmap

Module VIII: Conjunctions

To assimilate the knowledge of the conjunctions learnt indirectly so far

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:

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

SPANISH – III**Course Code: FLS311****Credit Units: 02****Course Objective:**

To enable students acquire knowledge of the Set/definite expressions (idiomatic expressions) in Spanish language and to handle some Spanish situations with ease.

Course Contents:**Module I**

Revision of earlier semester modules

Set expressions (idiomatic expressions) with the verb *Tener, Poner, Ir...*

Weather

Module II

Introduction to *Gustar...* and all its forms. Revision of *Gustar* and usage of it

Module III

Translation of Spanish-English; English-Spanish. Practice sentences.

How to ask for directions (using *estar*)

Introduction to IR + A + INFINITIVE FORM OF A VERB

Module IV

Simple conversation with help of texts and vocabulary

En el restaurante

En el instituto

En el aeropuerto

Module V

Reflexives

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:

- Español, En Directo I A
- Español Sin Fronteras -Nivel Elemental

CHINESE – III**Course Code: FLC311****Credit Units: 02****Course Objective:**

Foreign words are usually imported by translating the concept into Chinese, the emphasis is on the meaning rather than the sound. But the system runs into a problem because the underlying name of personal name is often obscure so they are almost always transcribed according to their pronunciation alone. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

Course Contents:**Module I**

Drills
 Dialogue practice
 Observe picture and answer the question.
 Introduction of written characters.
 Practice reading aloud
 Practice using the language both by speaking and by taking notes.
 Character writing and stroke order

Module II

Measure words
 Position words e.g. inside, outside, middle, in front, behind, top, bottom, side, left, right, straight.
 Directional words – beibian, xibian, nanbian, dongbian, zhongjian.
 Our school and its different building locations.
 What game do you like?
 Difference between “hii” and “neng”, “keyi”.

Module III

Changing affirmative sentences to negative ones and vice versa
 Human body parts.
 Not feeling well words e.g. ; fever, cold, stomach ache, head ache.
 Use of the modal particle “le”
 Making a telephone call
 Use of “jiu” and “cal” (Grammar portion)
 Automobiles e.g. Bus, train, boat, car, bike etc.
 Traveling, by train, by airplane, by bus, on the bike, by boat etc.

Module IV

The ordinal number “di”
 “Mei” the demonstrative pronoun e.g. mei tian, mei nian etc.
 use of to enter to exit
 Structural particle “de” (Compliment of degree).
 Going to the Park.
 Description about class schedule during a week in school.
 Grammar use of “li” and “cong”.
 Comprehension reading followed by questions.

Module V

Persuasion-Please don't smoke.
 Please speak slowly
 Praise – This pictorial is very beautiful
 Opposites e.g. Clean-Dirty, Little-More, Old-New, Young-Old, Easy-Difficult, Boy-Girl, Black-White, Big-Small, Slow-Fast ... etc.
 Talking about studies and classmates
 Use of “it doesn't matter”
 Enquiring about a student, description about study method.
 Grammar: Negation of a sentence with a verbal predicate.

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:

- “Elementary Chinese Reader Part I, Part-2” Lesson 21-30

PROJECT

Course code: MTB 460

Credit Units: 24

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:

➤ 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.

➤ 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 sections, 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**

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

➤ **Future prospects**

➤ **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

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: Evaluation will be done by external examiner

Project Report	50
Viva Voce	50
Total	100

AANANDAM (RUSA – Govt. of Rajasthan)

Course Code: AND001/002/003

Credit:2 /sem

Ref: 27.11, Academic Council of AUR

INTRODUCTION

Aanandam is a credited subject that aims to instill **the joy of giving** and sharing in young people through community participation, helping them to be responsible citizens and be initiators of change for a healthy society. A daily act of goodness and charity will infuse the habit of community service in students. The faculty will emphasize shift in focus-Happiness is not in acquiring things, but permanent happiness comes from giving, sharing, and caring for someone.

The faculty will inspire students for Individual Social Responsibility (ISR) and will inculcate the qualities of compassion, an open mind, a willingness to do whatever is needed and positive attitude in students. Imagination and Creativity are to be appreciated. An aim and a vision are to be developed in students.

OUTCOME OF AANANDAM COURSE

The student should develop:

- Awareness and empathy regarding community issues
- Interaction with the community and impact on society
- Interaction with mentor and development of Student teacher relationship
- Interaction among students, enlarge social network
- Cooperative and Communication skills and leadership qualities
- Critical thinking, Confidence and Efficiency

AANANDAM: COMMUNITY SERVICE

- Community service programs are very effective for students' **personal** and **social**, ethical, and **academic** development. These effects depend on the characteristics of the programs chosen
- Involvement of students in community work has an impact on development of student **skills, creativity, critical thinking, and innovative powers. Passion and Positivity** are basic requirements for Community service
- They would **examine social challenges** /problems, **assess the needs** of the community, **evaluate** previous implemented projects, and **think of further solutions**
- They would learn to cooperate and collaborate with other agencies and inculcate leadership qualities.

BENEFITS TO THE STUDENTS

Students should dedicate time as a volunteer as it helps them to:

- apply their knowledge and skills to solve specific community problem
- learn to plan, lead, and organize community events have a sense of belonging to their college campus and community and find something they are interested in doing during their free time
- make new friends, expand social network, and boost social skills and mental health.
- obtain employment

- be useful to society as it will protect them against stress, frustration, and depression

ABOUT AANANDAM COURSE

Students are expected to engage in:

- An individual act of goodness – caring, sharing and giving (time and energy) everyday group activity – a project in service of the local community (Group Community Service Project)
- **Aanandam Day- will be celebrated once a month in the last week as decided by Director/HoIs.**
- **It is a credited subject. Marks/ Grades both will be entered in the marks sheet as per the university rules.**
- Two credits for a project in each semester
- 50 marks for each project to be completed in 4 Months.

DIRECTIONS FOR STUDENTS

- Do at least one individual act of goodness each day and Record this act in a dedicated diary/register
- Share this dedicated diary/register in a 30-minute **Anandam period** with the mentor and share your experience with the class
- Students in **Semester scheme** must take up one Group Community Service Project per semester
- Students in **Annual scheme** must take up two Group Community Service Projects per year
- Take one Group Community Service Project from **August to November**
- Take one Group Community Service Project from **January to April**
- The students must take photographs to document their work
- The students can obtain certificate from the NGO/ Government Agency they are working with for Group Community Service Project
- The students may submit newspaper cuttings
- The students must participate in the **Aanandam Day** by displaying charts of their Group Community Service Project
- They can make power point presentations of their project which will help them get better grades

ROLE OF FACULTY MENTOR

- The mentor will **maintain a register** wherein the entry of act of goodness will be tick mark and be submitted every day to the Director/HoIs
- Review every student's dedicated register to see if they have recorded an act of goodness for that day and mark in register. The **act will not be evaluated** - just if it was recorded or not. **(Be suggestive not judgmental)**
- In half an hour class some students and faculty will deliberate on the pleasure of giving and acts of goodness. This should be done by rotation so that all students get a chance to speak and express themselves
- The mentor will divide the class for the Group Community Service Project and record it in a register. **8-12 students can form a group** for project work.
- The students will opt the project of their choice.
- The mentors can mobilize the required resources and support for the projects. They can coordinate and collaborate with Government bodies or NGOs.
- The mentor will guide the students to write the Group Community Service Project Report.

- Mentors will review the project on monthly basis and submit the report to the nodal officer of the college to compile and share with higher authorities on Google spread sheet

ROLE OF DIRECTOR/HOIS

- Allot one period of half an hour for Aanandam course
- Assign all faculty members as mentors for this period of half an hour for students
- Each faculty will have one class to mentor
- Appoint one faculty as department Aanandam Coordinator to monitor the program in their department and submit the monthly report to the University Nodal Officer which he/she will submit further to DCE – Govt. of Rajasthan.
- To coordinate the **Aanandam Day** activities
- To organize **Aanandam Day** in the last week of the month. A film or motivational lecture by some philanthropist (Bhamashah, Collector, Janpratinidhi) should be organized for the benefit of students (to motivate and inspire them for community service)
- Photographs of the **Aanandam Day** should be displayed in department and these should be uploaded in the gallery of University web page on HTE portal
- A **Project Assessment Committee (PAC)** to be constituted to assess the project report.

PROJECT ASSESSMENT COMMITTEE

Formation of Project Assessment Committee

- **Director/HoIs**
- **One person from community**
- **Departmental Aanandam Coordinator**
- **Project Mentors (1 to 7 or more members)**

The number of mentors can vary depending on the number of projects and students in each department.

- University level PAC to be formed for university colleges and departments
- State level PAC to be formed at Commissionerate level for Universities

PROJECTS: SUGGESTIVE LIST

The students and mentor as per their interest would support activities of community service such as:

- literacy programs, in today's digital age many organizations/individuals might also need help with email and websites
- livelihood projects,
- time giving activities to adopted communities (awareness regarding Govt. programmes) sports like yoga, meditation, drills, and physical exercises in adopted areas
- activities on arts and culture such as restoration of traditional art and culture and monuments.
- understand their responsibility in taking care of environment and appreciating cultural diversity
- While some students would be interested in awareness about environment such as protecting and preserving natural resources and animal species (the flora and the fauna). Plantation and animal care centers

- A few would be concerned with healthcare like medical and dental missions, first-aid training, etc.
- Another group may be formed for attending to old people(who have money but need assistance for market and groceries) [Time Bank]
- Another group may be formed for civic activities, awareness programmes.
- Local social problems to be taken up and solutions devised
- Innovations and Startups to be encouraged
- help plant a community garden, help out at a children's camp

THE PROJECT REPORT

The project report should be guided by the mentor and shall contain:

- **Synopsis:** clearly stating objectives and activities to be undertaken. Problem identifying and problem-solving projects to be taken up.
- Details of the **Mentor and the Participants are to** be given (name of mentor, name of participants, phone number/mobile no, email, and address)
- Location / community where the work was carried out
- Details of Activities performed are to be given with date
- Number of beneficiaries and impact on the society(the object should be to empower the community and make them self-reliant)
- Photographs taken for documentation of work should be submitted
- Media coverage of the projects should be attached if any
- Students should also submit their certificates from the government bodies and or non government bodies they collaborate with, if any
- Photographs of **Display charts** or **ppt/video** prepared while presentation on the group community service in the **Aanandam Day** must be submitted along with the report
- The Group Community Service Project Report will be submitted by the Student group leader under the guidance of the mentor to the Director/HoIs of the Department.
- The Director/HoIs should get the best report (more than one if required) of the Group Community Service Project uploaded on the HTE website and on the University page
- The Director/HoIs will forward the best report of the department to the Nodal Officer of the University.
- University will forward the report to the state level committee.

PROCEDURE FOR EVALUATION

- **Project Assessment Committee** will assess the Group Community Service Project Report
- submitted by the students, in the duly filled given format, based on:
- Submission of the student dedicated daily diary as per student attendance norms
- students' performance and interaction with the community
- presentation of the project report
- impact on society and the course outcome results

Format for evaluation by Project Assessment Committee (Total max marks 50)

- Submission of register of everyday activity mandatory (if register is not submitted by the student, he/she will not be evaluated and considered for the award)
- Report contains presentation /video (**max.10 marks**)
- Photographs of Students' participation and involvement of community (**max.10 marks**)
- Problem solving and challenging issues addressed/innovation (**max. 30 marks**)

EVALUATION: GRADES EQUIVALENCE

Project Assessment Committee constituted will assess the projects
For 4 months Group Community Service Project the grade equivalence is as follows:

Total: 64 Hrs

Grading Marks

C grade =32 hrs

B grade >32hrs to <=44hrs

A grade >44hrs to <=54hrs

O grade >54hrs to <=64hrs

AWARD AND RECOGNITION DEPARTMENT, UNIVERSITY AND STATE LEVEL

- Based on the impact on society and Aanandam project outcome one Group Community Service Project will be selected by the Project Assessment Committee at department level for award of best project of the Department.
- The best project report of the University will be submitted to the Director, College Education/ Department of Higher and Technical Education for contesting the state level award
- State Level Project Assessment Committee will evaluate projects received from all the universities (one each).
- A certificate/letter of appreciation to the winning teams (Nodal officer of the university, students, and mentor of the project) will be given