



AMITY UNIVERSITY
— R A J A S T H A N —

**AMITY INSTITUTE OF MICROBIAL TECHNOLOGY
(AIMT)**

**B.Sc. (Hons.) MICROBIOLOGY
Programme Code: BSM**

12892

Duration – 3 Years Full Time

SYLLABUS

(Programme Structure)

Choice Based Credit System (CBCS)

2021

Program Learning Outcomes - PLO

- Define and explain various microbiology disciplines of the core theories to be applicable in industries and research.
- Describe and demonstrate the microbial cell functioning for their replication, survival and interaction with environment and host.
- Explain the theoretical and practical basis of the tools and techniques common to microbiology.
- Evaluate and respond to given challenges using microbiological skills.

Credits Summary

B.Sc. (Hons.) Microbiology							
(03 Years/ 06 Semesters)							
Semester	Core Course (CC)	Domain Electives (DE)	Value Added Course (VAC)	Minor Track (MT)	Non-Teaching Credit Courses (NTCC)	Anandam	Total
I	16	-	4	-	0	2	22
II	19	-	4	3	0	2	28
III	15	3	4	3	3	2	30
IV	14	3	4	3	0	2	26
V	13	3	4	3	3	2	28
VI	25	-	-	-	1	0	26
Total	102	9	20	12	7	10	160

Total Credits (22+28+30+26+28+26) = 160

CC = Core Course

DE = Domain Elective

OE = Open Elective

VA = Value Added Course

NTCC = Non -Teaching Credit Courses (NTCC)



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

FIRST SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 101	Introduction of Microbiology	CC	3	-	-	3
BSM 102	Life Sciences- I	CC	3	-	-	3
BSM 103	Chemistry- I	CC	3	-	-	3
BSM 104	Biochemistry & Biophysics	CC	3	-	-	3
BSM 122	Life Sciences- I Lab.	CC	-	-	4	2
BSM 123	Chemistry- I Lab.	CC	-	-	4	2
BCS 101	English – I	VA	1	-	-	1
BSS 103	(Behavioural Sciences-I) Understanding Self for Effectiveness	VA	1	-	-	1
FLT 101 FLG 101 FLS 101 FLC 101	Foreign Language – I French German Spanish Chinese	VA	2	-	-	2
AND 001	Anandam– I	NTCC	-	-	-	2
TOTAL						22



Program Name: B.Sc. (Hons.) MICROBIOLOGY

SECOND SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 201	Bacteriology & Virology	CC	3	1	-	4
BSM 202	Mycology & Phycology	CC	3	-	-	3
BSM 203	Life Sciences- II	CC	3	-	-	3
BSM 204	Chemistry- II	CC	3	-	-	3
BSM 221	Bacteriology & Virology Lab	CC	-	-	4	2
BSM 222	Mycology & Phycology Lab.	CC	-	-	4	2
BSM 224	Chemistry- II Lab.	CC	-	-	4	2
Minor Track-I		MT	3	-	-	3
BCS 201	English – II	VA	1	-	-	1
BSS 203	Behavioural Science-II (Problem Solving and Creative Thinking)	VA	1	-	-	1
FLT 201 FLG 201 FLS 201 FLC 201	Foreign Language – II French German Spanish Chinese	VA	2	-	-	2
AND 002	Anandam--II	NTCC	-	-	-	2
TOTAL						28

Note: -Term Paper/ Case Study topic distribution before summer vacations and will be evaluated in Third Semester.



Program Name: B.Sc. (Hons.) MICROBIOLOGY

THIRD SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 301	Microbial Physiology & Metabolism	CC	3	-	-	3
BSM 302	Molecular Biology & RDT	CC	3	1	-	4
EVS 003	Environmental Sciences	CC	3	1	-	4
BSM 321	Biochemistry & Microbial Physiology Lab.	CC	-	-	4	2
BSM 322	Molecular Biology & RDT Lab.	CC	-	-	4	2
Domain Elective-I : Choose any one from the following courses						
BSM 311	Bionanotechnology & Biosensors	DE	3	-	-	3
BSM 312	Soil Microbiology					
BSM 313	Food Biotechnology					
BSM 314	Cell Biology					
Minor Track- II		MT				3
BSM 330	Term Paper Evaluation	NTCC	-	-	-	3
BCS 301	Communication Skills – I	VA	-	-	-	1
BSS 303	Behavioural Science-III (Interpersonal Communication & Relationship Management)	VA	-	-	-	1
FLT 301 FLG 301 FLS 301 FLC 301	Foreign Language – III French German Spanish Chinese	VA	-	-	-	2
AND003	Anandam-III	NTCC	-	-	-	2
TOTAL						30



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

FOURTH SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 401	Immunology	CC	3	1	-	4
BSM 402	Fermentation Technology & Industrial Microbiology	CC	3	-	-	3
BSM 403	Medical Microbiology	CC	3	-	-	3
BSM 421	Immunology & Medical Microbiology Lab.	CC	-	-	4	2
BSM 422	Fermentation Technology & Industrial Microbiology Lab.	CC	-	-	4	2
Domain Elective-II: Choose any one from the following courses						
BSM 411	Bioinformatics	DE	3	-	-	3
BSM 412	Pharmaceutical Technology & Microbiology					
BSM 413	Biomaterial Science					
BSM 414	Inheritance Biology					
Minor Track- III		MT				3
BCS 401	Communication Skills – II	VA	-	-	-	1
BSS 403	Behavioural Science-IV (Group Dynamics and Team Building)	VA	-	-	-	1
FLT 401	Foreign Language – IV	VA	-	-	-	2
FLG 401	French					
FLS 401	German					
FLC 401	Spanish					
AND 004	Anandam-IV	NTCC	-	-	-	2
TOTAL						26

Note: - Students will be required to undergo summer training of 45 days in industry/ research institution/ academic institution. Work progress will be evaluated in V semester.



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

FIFTH SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 501	Microbial Ecology & Diversity	CC	3	-	-	3
BSM 502	Microbial Genetics & Genomics	CC	3	-	-	3
BSM 503	Plant Pathology	CC	3	-	-	3
BSM 521	Microbial Ecology & Plant Pathology Lab.	CC	-	-	4	2
BSM 522	Microbial Genetics & Genomics Lab.	CC	-	-	4	2
Domain Elective-III: Choose any one from the following courses						
BSM 511	Industrial Safety & Management	DE	3	-	-	3
BSM 512	IPR & Bioethics					
BSM 513	GMP & Microbial Quality Control					
BSM 514	Clinical Research & Pharmacovigilance					
Minor Track- IV		MT				3
BSM 550	Summer Training Evaluation	NTCC	-	-	-	3
BCS 501	Communication Skills – III	VA	-	-	-	1
BSS 503	Behavioural Science-V (Individual, Society and Nation)	VA	-	-	-	1
FLT 501 FLG 501 FLS 501 FLC 501	Foreign Language – V French German Spanish Chinese	VA	-	-	-	2
AND 005	Anandam-V	NTCC	-	-	-	2
TOTAL						28



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

SIXTH SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 601	Bioanalytical Techniques & Statistics	CC	3	-	-	3
BSM 602	Food & Dairy Microbiology	CC	3	-	-	3
BSM 603	Marine Microbiology	CC	3	-	-	3
BSM 650	Educational/ Industrial Tour	NTCC	-	-	-	1
BSM 660	In House Project	CC	-	-	-	16
TOTAL						26

* One Industrial /Educational Tour can be organized in any Semester of Program and report evaluated will be in Semester VI

Total Credits (22+28+30+26+28+26) = 160



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

FIRST SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 101	Introduction of Microbiology	CC	3	-	-	3
BSM 102	Life Sciences- I	CC	3	-	-	3
BSM 103	Chemistry- I	CC	3	-	-	3
BSM 104	Biochemistry & Biophysics	CC	3	-	-	3
BSM 122	Life Sciences- I Lab.	CC	-	-	4	2
BSM 123	Chemistry- I Lab.	CC	-	-	4	2
BCS 101	English – I	VA	1	-	-	1
BSS 103	(Behavioural Sciences-I) Understanding Self for Effectiveness	VA	1	-	-	1
FLT 101 FLG 101 FLS 101 FLC 101	Foreign Language – I French German Spanish Chinese	VA	2	-	-	2
AND 001	Anandam– I	NTCC		-	-	2
TOTAL						22

Introduction of Microbiology

Course Code: BSM 101

Credit Units: 03

Course Objective: -

Aim of the course to introduce the students with microbial world and get them familiarize with the routine tools of Microbiology

Module I: - Historical development of Microbiology

Development of microbiology as a discipline, Spontaneous generation vs. biogenesis, development of various microbiological techniques, concept of fermentation, establishment of fields of medical microbiology, immunology and environmental microbiology with special reference to the work of following scientists : Anton von Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman, Elie Metchnikoff, Norman Pace, Carl Woese and Ananda M. Chakraborty

Module II: - Microbial World

Systems of classification: Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility.

Difference between prokaryotic and eukaryotic microorganisms

General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria- Gram positive, Gram negative, archeobacteria, Algae, Fungi and Protozoa) with emphasis cell structure, distribution, occurrence, mode of reproduction, cultural characteristics, biochemical characteristics and economic importance.

Module III: - Staining, Sterilization & Disinfection

Staining: Principle of staining, Types of staining– Simple, Differential (Gram, Spore, AFB), Negative staining, Capsule staining, Giemsa Staining, LPCB, KOH Mount

Sterilization and Disinfection- Principles- Methods of Sterilization – Physical methods – Dry heat- Moist heat, Filtration (Membrane & HEPA) - Radiation sterilization and mechanism– Chemical Sterilization -Chemical agents & Mode of action – Phenol coefficient test- Sterility testing

Module IV: - Cultivation of Microbes

Nutritional diversity of microbes, Culture & -Media preparation - Solid and Liquid- Types of Media – Semi-Synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media, Natural components as media and Special Purpose Media (one eg for each type). Anaerobic culture

technique – Wright’s tube, Roll tube, McIntost fildes jar method. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate

Module V: - Preservation and Maintenance of Microbes

Preservation of pure culture: Periodic subculture methods, cold storage, freezing, deep-freezing, lyophilization methods, storage using liquid nitrogen, comparative advantages and disadvantages of different methods

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). *Introductory Mycology*. 4th edition. John and Sons, Inc.
2. Atlas RM. (1997). *Principles of Microbiology*. 2nd edition. WM.T.Brown Publishers.
3. Cappucino J and Sherman N. (2010). *Microbiology: A Laboratory Manual*. 9th edition. Pearson Education limited.
4. Madigan MT, Martinko JM and Parker J. (2009). *Brock Biology of Microorganisms*. 12th edition. Pearson/Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. (1993). *Microbiology*. 5th edition. McGraw Hill Book Company.
6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). *General Microbiology*. 5th edition. McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. 9th edition. Pearson Education.
8. Vashishta BR and Sinha AK. (2008). *Fungi*. S. Chand and Company Ltd.
9. Vashishta BR. (2005). *Algae*. 3rd edition. S. Chand and Company Limited, New Delhi.
10. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein’s Microbiology*. 7th edition. McGraw Hill Higher Education.

Life Sciences-I

Course Code: BSM 102

Credit Units: 03

Course Objective: -

Aim of the course to introduce with fundamentals of plant sciences.

Module I: -Evolution and Diversity of Bryophytes & Pteridophytes

Theories of evolution

Bryophytes: general characteristics, classification, reproduction, affinities, vegetative and reproductive structures- sphagnus & anthoceros

Pteridophytes: General features, classification, stellar evolution, anatomy & development, vegetative & reproductive system- Ryhnia, lycopodium, marsilea

Module II: -Diversity of gymnosperms & angiosperms

Gymnosperms: General charaters, classification, morphology, anatomy, vegetative & reproductive parts- cycas, pinus, ephidra

Angiosperms: Principles of classification, nomenclature- Bentham & Hooker, taxonomic study of Ranunculaceae, Brassicaceae, Fabaceae, Poaceae. External morphology of vegetative and floral parts, Structure & development of male & female gametophytes.

Module III: -Plant Anatomy & Physiology

Tissue & Cell walls, root-leaf-stem, vascular-cambium, secondary growth & periderm, adaptations, secretory & excretory system

Plant water relationship- uptake & conduction, nutrient uptake & deficiency- toxicity, photosynthesis & chemosynthesis, aerobic & anaerobic respiration

Module IV: -Embryology& Ecology

Ultrastructure of anther & ovule, pollination & fertilization, self incompatability, endosperm, polyembryony & apomixes

Distribution & characteristics of population, food chain, food web, pyramids, succession, ecological speciation, biomass study, bioenergetics. Concept of fossilization.

Examination Scheme:

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Bhatnager, S.P. and Moitra, A. 1996 Gymnosperms. New Age International (P) Ltd. Publishers, New Delhi.
2. Buchanan, B., Gruissem, W. and Jones, R. 2000 Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.
4. Richardson, D.H.S. 1981 The Biology of Mosses. John Wiley and Sons, New York.
5. Sambamurty 2008 A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. IK International Publishers.
6. Shaw, A.J. and Goffinet, B. (2000) Bryophyte Biology. Cambridge University Press.
7. Vander-Poorteri 2009 Introduction to Bryophytes. COP. 8. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
8. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
9. Bhatnagar S.P. and Mohitra A 1996 Gymnosperms. New Age Publishers, New Delhi
10. Mauseth, J.D. 1988 Plant Anatomy. The Benjamin/Cummings Publisher, USA.

Chemistry-I

Course Code: BSM 103

Credit Units: 03

Course Objective: -

Aim of the course to introduce the students with principles of inorganic and physical chemistry.

Module I

Recapitulation of Bohr's theory and its limitations, dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg Uncertainty principle. Schrodinger equation, applications of Schrodinger equation for hydrogen atom. Need of polar coordinates, transformation of Cartesian coordinates into polar coordinates. Radial and angular parts of the hydrogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals. (Only graphical representation).

Vector atom model and Discovery of spin quantum number, and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals in atoms. Stability of half-filled and completely filled orbitals,

Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distances with special reference to 1s and 2s atomic orbitals. Quantum numbers & their significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes.

Module II

Modern periodic table, periodicity in properties of elements: atomic, ionic & covalent radii, electron affinity, ionization energy, and electronegativity. Chemistry of lanthanides & actinides

Module III

Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of an ionic bond. Energy considerations in ionic bonding, lattice energy, solvation energy and their importance in the context of stability and solubility of ionic compounds.

Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications. Fajan's rules, covalent character in ionic compounds, dipole moment and percentage ionic character.

Covalent bonding: VB Approach Shapes of some inorganic molecules and ions on the basis of VSEPR theory, concept of hybridization of resonance and its importance.

Module IV

Chemical Thermodynamics

State of a system, state variables, intensive and extensive variables, concept of heat and work, thermodynamic equilibrium, thermodynamic properties, various types of systems and processes. First Law of thermodynamics. Calculation of work (w), heat (q), changes in internal energy (ΔU) and enthalpy (ΔH) for expansion or compression of ideal gases under isothermal and adiabatic conditions for both reversible and irreversible processes. Calculation of w , q , ΔU and ΔH for processes involving changes in physical states.

Thermochemistry: Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Second Law of thermodynamics, Carnot cycle, concept of entropy, Gibbs free energy, Calculations of entropy change and free energy change for reversible and irreversible processes under isothermal and adiabatic conditions. Criteria of spontaneity. Gibbs - Helmholtz equation. Maxwell's relations. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Module V

Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect, Salt hydrolysis – calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility, solubility product and its applications. Qualitative treatment of acid base titration curves (calculation of pH at various stages of HCl – NaOH titration only). Theory of acid – base indicators.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Barrow GM. (2007). Physical Chemistry. Tata McGraw_Hill.
2. Castellan GW. (2004). Physical Chemistry. 4th edition. Narosa.
3. Cotton FA and Wilkinson G. (Year). Basic Inorganic Chemistry. John Wiley.
4. Douglas, McDaniel and Alexader. (Year). Concepts and Models in Inorganic Chemistry. John Wiley.
5. Huheey JE, Keiter E and Keiter R. (Year). Inorganic Chemistry: Principles of Structure and Reactivity. Pearson Publication.
6. Khosla B.D. Senior Practical Physical Chemistry. R. Chand & Co.
7. Kotz JC, Treichel PM and Townsend JR. (2009). General Chemistry. Cengage Learning India Pvt. Ltd., New Delhi.
8. Mahan BH. (1998). University Chemistry. 3rd edition. Narosa
9. Vogel A.I. Vogel's Qualitative Inorganic Analysis. 7th edition. Prentice Hall
10. Vogel A.I. Vogel's Quantitative Chemical Analysis. 6th edition. Prentice Hall.

Biochemistry & Biophysics

Course Code: BSM 104

Credit Units: 03

Course Objective: -

Aim of the course to introduce the students with biochemical's of microbial world and get them familiarize with the routine tools of Biochemistry.

Module I: - Introduction to Biochemistry

Chemical foundation of biology, Acid, Base, Buffer solution, pH, Handerson Hasselbalch equation, Water as a biological solvent, Importance of covalent and non-covalent interaction in biology

Module II: - Amino Acids, Proteins & Enzymes

Types & properties of amino acids, physical & chemical, peptide bonds, Ramachandran Plot, folding of peptide chains into regular repeating structure (helix, pleated sheets, β turns) in polypeptides, Levels of structure in protein architecture, forces stabilizing structure and shape of proteins, Introduction to enzymes, models and applications.

Module III: - Nucleic Acids

Structure & properties of purine and pyrimidine bases. Nucleosides and nucleotides, Double helical model of DNA & responsible molecular forces. Methods for isolation and purification of nucleic acids.

Module IV: - Carbohydrates & Lipids

Classification of carbohydrates, Properties and structure of few biologically essential polysaccharides, Structure & functions of lipids, fatty acids, triacylglycerols, sphingomylin, Liposomes, biological membranes and micelles.

Module V: - Thermodynamics & chemical kinetics

Laws of thermodynamics, concept of enthalpy, concept of entropy, Gibb's free energy, high energy phosphate bonds, chemical kinetics – rate, order, molecularity of reactions, Energy of activation

Module V: - Spectroscopic Techniques, electrophoretic & Microbiological techniques

Beer's Lambert Law, U.V. visible spectrophotometry, IR spectroscopy, Principles and applications of electrophoretic techniques in purification and characterization of biomolecules - SDS - PAGE & agarose gel electrophoresis, centrifugation, laminar air flow/biosafety cabinets.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Principles of Biochemistry; Lehninger, Nelson & Cox.
2. Biochemistry; Luberts Stryer. W.H. Freeman and Company, New York.
3. Fundamentals of Biochemistry; J.L. Jain, Chand and Co., New Delhi.
4. An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill. 1988, David T. Plummer.
5. Biochemical Methods, 2nd edition, New Age International Publishers edn. 1996, S.S. Sadasivan and A Mamekam.
6. A Biologists Guide to Principles and Techniques of Practical Biochemistry, Wilson and Goulding, ELBS Publishers, Britain.
7. Biophysical Chemistry - Principles and Techniques. Upadhyay, Upadhyay and Nath, 3rd Edition, 2002. Himalaya Publishing House.
8. Physical Chemistry with Application to Biological systems: Raymond Chang, 2nd Edition, 1989, MacMillan Publishing Co. 2 No. New York.

Life Sciences –I Lab.

Course Code: BSM 122

Credit Units: 02

Course objectives

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 102

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Chemistry – I Lab.

Course Code: BSM 123

Credit Units: 02

Course objectives

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 103

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

ENGLISH-I

Course Code: BCS 101

Credit Units: 01

Course Objective:

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

Course Contents:

Module I: Vocabulary

Use of Dictionary

Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I

Articles

Parts of Speech

Tenses

Module III: Essentials of Grammar - II

Sentence Structure

Subject -Verb agreement

Punctuation

Module IV: Communication

The process and importance

Principles & benefits of Effective Communication

Module V: Spoken English Communication

Speech Drills

Pronunciation and accent
Stress and Intonation

Module VI: Communication Skills-I

Developing listening skills
Developing speaking skills

Module VII: Communication Skills-II

Developing Reading Skills
Developing writing Skills

Module VIII: Written English communication

Progression of Thought/ideas
Structure of Paragraph
Structure of Essays

Module IX: Short Stories

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

Module X: Poems

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

Text & References:

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

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

BEHAVIOURAL SCIENCE - I
(UNDERSTANDING SELF FOR EFFECTIVENESS)

Course Code: BSS 103

Credit Units: 01

Course Objective:

This course aims at imparting:

Understanding self & process of self exploration

Learning strategies for development of a healthy self esteem

Importance of attitudes and its effective on personality

Building Emotional Competence

Course Contents:

Module I: Self: Core Competency

Understanding of Self

Components of Self – Self identity

Self concept

Self confidence

Self image

Module II: Techniques of Self Awareness

Exploration through Johari Window

Mapping the key characteristics of self

Framing a charter for self

Stages – self awareness, self acceptance and self realization

Module III: Self Esteem & Effectiveness

Meaning and Importance

Components of self esteem

High and low self esteem

Measuring your self esteem

Module IV: Building Positive Attitude

Meaning and nature of attitude

Components and Types of attitude

Importance and relevance of attitude

Module V: Building Emotional Competence

Emotional Intelligence – Meaning, components, Importance and Relevance

Positive and Negative emotions

Healthy and Unhealthy expression of emotions

Module VI: End-of-Semester Appraisal

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

Examination Scheme:

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

Text & References:

- Davis, K. Organizational Behaviour,
- Hoover, Judith D. (2002). Effective Small Group and Team Communication, Harcourt College Publishers.
- Charles: Team Management, Dick, Mc Cann & Margerison, Edition, viva books (1992)
- Bates, A. P., & Julian, J. Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G. (1985). Oxford Textbook of Public Health, Vol. 4.

- LaFasto & Larson. (2001). *When Teams Work Best*, Response Books (Sage), New Delhi.
- Pfeiffer J W. (1996). *Theories and Models in Applied Behavioural Science*, Vol 2, Group Pfeiffer & Company.
- Smither R. D. (1994). *The Psychology of Work and Human Performance*, Harper Collins College Publishers.

FRENCH - I

Course Code: FLT 101

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 101

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 101

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 101

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



Program Name: B.Sc. (Hons.) MICROBIOLOGY

SECOND SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 201	Bacteriology & Virology	CC	3	1	-	4
BSM 202	Mycology & Phycology	CC	3	-	-	3
BSM 203	Life Sciences- II	CC	3	-	-	3
BSM 204	Chemistry- II	CC	3	-	-	3
BSM 221	Bacteriology & Virology Lab	CC	-	-	4	2
BSM 222	Mycology & Phycology Lab.	CC	-	-	4	2
BSM 224	Chemistry- II Lab.	CC	-	-	4	2
Minor Track-I		MT	3	-	-	3
BCS 201	English – II	VA	1	-	-	1
BSS 203	Behavioural Science-II (Problem Solving and Creative Thinking)	VA	1	-	-	1
FLT 201	French	VA	2	-	-	2
FLG 201	German					
FLS 201	Spanish					
FLC 201	Chinese					
AND 002	Anandam--II	NTCC	2	-	-	2
TOTAL						28

Note: -Term Paper/ Case Study topic distribution before summer vacations and will be evaluated in Third Semester.

Bacteriology & Virology

Course Code: BSM 201

Credit Units: 04

Course Objective: -

Aim of this course is to introduce the students with general accounts of bacterial & viral classification, diversity, distribution and their importance

Module I: - Cell Structure

Cell organization: Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili. Cell-wall: Composition and detailed structure of gram positive and gram-negative cell walls, Archaeobacterial cell wall, lipopolysaccharide (LPS), sphaeroplasts, protoplasts, and L-forms. Effect of antibiotics and enzymes on the cell wall.

Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes.

Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids

Endospore: Structure, formation, stages of sporulation.

Module II: - Bacterial Systematics

Aim and principles of classification, systematics and taxonomy, concept of species, taxa, strain; conventional, molecular and recent approaches to polyphasic bacterial taxonomy, evolutionary chronometers, rRNA oligonucleotide sequencing, signature sequences, and protein sequences.

Differences between eubacteria and archaeobacteria.

Module III: - Important archaeal and eubacterial groups

According to Bergey's Manual of Systematic Bacteriology (Second Edition)

Archaeobacteria: General characteristics, phylogenetic overview, genera belonging to Nanoarchaeota (Nanoarchaeum), Crenarchaeota (Sulfolobus, Thermoproteus) and Euryarchaeota [Methanogens (Methanobacterium, Methanocaldococcus), thermophiles (Thermococcus, Pyrococcus, Thermoplasma), and Halophiles (Halobacterium, Halococcus)]

Eubacteria: Morphology, metabolism, ecological significance and economic importance of following groups:

Gram Negative: Non proteobacteria, Alpha proteobacteria, Beta proteobacteria, Gamma proteobacteria, Delta proteobacteria, Epsilon proteobacteria

Gram Positive: Low G+ C (Firmicutes), High G+C (Actinobacteria)

Cyanobacteria: An Introduction

Module IV: - Introduction of Virology

Discovery of viruses, nature and definition of viruses, general properties of viruses. Capsid symmetry, enveloped and non-enveloped viruses. Structure: Concept of viroids, virusoids, satellite viruses and prions. Theories of viral origin. Isolation, purification and cultivation of viruses.

Module V: - Viral Taxonomy & Features of Viral Genomes

Classification and nomenclature of different groups of viruses infecting microbes, plants and animals

Salient features of viral genomes: Unusual bases (TMV, T4 phage), overlapping genes (Φ X174, Hepatitis B virus), alternate splicing (Picornavirus), terminal redundancy (T4 phage), terminal cohesive ends (lambda phage), ambisense genomes (arenavirus), partial double stranded genomes (Hepatitis B), long terminal repeats (retrovirus), segmented (influenza virus) and non segmented genomes (picornavirus), capping and tailing (TMV)

Module VI: - Bacteriophages & Oncogenic Viruses

Diversity, classification, one step multiplication curve, lytic and lysogenic phages (lambda and P1 phage), concept of early and late proteins, regulation of transcription in lambda phage and applications of bacteriophages.

Types of oncogenic DNA and RNA viruses. Concepts of oncogenes, proto-oncogenes and tumor suppressor genes.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2006). Brock Biology of Micro-organisms. 8th edition. Parker J. Prentice Hall International, Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.
5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht
6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.
9. Dimmock, NJ, Easton, AL, Leppard, KN (2007). Introduction to Modern Virology. 6th edition (First Indian reprint 2007), Blackwell Publishing Ltd.
10. Carter J and Saunders V (2007). Virology: Principles and Applications. John Wiley and Sons.
11. Flint SJ, Enquist, LW, Krug, RM, Racaniello, VR, Skalka, AM (2004). Principles of Virology, Molecular biology, Pathogenesis and Control. 2nd edition. ASM press Washington DC.
12. Levy JA, Conrat HF, Owens RA. (2000). Virology. 3rd edition. Prentice Hall publication, New Jersey.
13. Wagner EK, Hewlett MJ. (2004). Basic Virology. 2nd edition. Blackwell Publishing.
14. Mathews. (2004). Plant Virology. Hull R. Academic Press, New York.
15. Nayudu MV. (2008). Plant Viruses. Tata McGraw Hill, India.

Mycology & Phycology

Course Code: BSM 202

Credit Units: 03

Course Objective: -

Aim of this course is to introduce the students with structures of algae and fungi, their classification system, reproduction and economic importance

Module I: - Introduction to

Distribution and classification of algae, algal nutrition, thallus organization, Applications of algae in Agriculture, Industry, Environment and Food

Module II: - Lifecycles of algae

-Chlorophyceae: *Volvox*, *Coleochaete*

-Charophyceae: *Chara*

-Diatoms: General features with reference to pinnate and centric diatoms

-Xanthophyceae: *Vaucheria*

-Phaeophyceae: *Ectocarpus*

-Rhodophyceae: *Polysiphonia*

-Cyanobacteria: *Nostoc*

Module III: - Classification of fungi

Distribution, fungal cell structure, general characteristics, Classification of fungi, physiology and reproduction, importance in Agriculture, Environment, Industry, Medicine, Food, Biodeterioration (of wood, paper, textile, leather), Mycotoxins

Module IV: - Lifecycles of fungi

-Cellular slime molds - *Dictyostelium*

-True slime molds (Myxomycetes) - *Physarum*

-Oomycetes - *Saprolegnia*, *Phytophthora*

-Chytridiomycetes - *Neocallimastix*

-Zygomycetes – *Mucor*

-Ascomycetes - *Saccharomyces*, *Penicillium*, *Neurospora*

-Basidiomycetes - *Agaricus*

-Deuteromycetes - *Candida, Alternaria*

Module V: - Lichens & Mycorrhizae

Structure, different, types, physiology, importance

Examination Scheme:

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books: -

1. Barasanti L and Guaaltieri P. (2006). *Algae: Anatomy Biochemistry and Biotechnology*. Taylor and Francis Group, New York.
2. Graham LE, Graham JM and Wilcox LW. (2009). *Algae*. 2nd edition. Benjamin Cumming, New York.
3. Kumar HD. (1990). *Introductory Phycology*. 2nd edition. Affiliated East Western Press.
4. Kumar HD. (1995). *The Text Book on Algae*. 4th edition. Affiliated East Western Press.
5. Lee RE. (1999). *Phycology*. 4th edition. Cambridge Press.
6. Sharma OP. (2005). *Textbook of Algae*. Tata McGraw Hill Publishing Co. Ltd.
7. Vashishta BR. (2005). *Algae*. 3rd edition. S. Chand and Company Ltd., New Delhi.
8. Alexopoulos CJ, Mims CW and Blackwell M. (1996). *Introductory Mycology*. 4th edition. John Wiley and Sons, Inc.
9. Dube HC. (1981). *An Introduction to Fungi*. Vikas Publishing House Pvt. Ltd.
10. Sumbali G. (2005). *The Fungi*. 1st edition. Narosa Publishing India House.
11. Vashishta BR and Sinha AK. (2008). *Fungi*. S. Chand and Company Ltd.
12. Webster J. (1980). *Introduction to Fungi*. 2nd edition. Cambridge University Press.

Life Sciences-II

Course Code: BSM 203

Credit Units: 03

Course Objective: -

Aim of the course to introduce with fundamentals of animal sciences.

Module I: - Non-Chordata

General characteristics, outline classification of protozoa, porifera, metazoan, chidinia, platyhelminthes, aschelminchets, annelid, arthropoda, mollusca & echinodermata

Module II: - Chordata

General account of chordates, pisces, amphibian, reptiles, aves & mammals

Module III: - Histology & Physiology

Concept & classification of various tissues & glands, bones- muscle-nervous system

Vasculatory, digestive, respiratory, reproductive, excretory & endocrine system

Module IV: - Animal Evolution

Theories of evolution, concept of species, gametogenesis & fertilization, evolution of man & mutation

Module V: - Applied Zoology

Production technology of apiculture, sericulture, fisheries, aquaculture, poultry, lac-culture.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGrawHill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers, Inc.
5. Weichert, C.K. (1970). Anatomy of Chordate. McGraw Hill.

6. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John wiley & sons, Inc.

Chemistry-II

Course Code: BSM 204

Credit Units: 03

Course Objective: -

Aim of the course to introduce the students with principles of organic and advances in chemistry.

Module I

Fundamentals of Organic Chemistry

Concept of hybridization of carbon. Cleavage of a covalent bond: homolysis and heterolysis. Electronic effects and their applications (inductive, electromeric, hyperconjugation and resonance). Structure and stability of reactive intermediates (carbocations, carbanions and free radicals). Relative strength of carboxylic acids (aliphatic, aromatic and halo-substituted aliphatic), alcohols, phenols and nitro-phenols. Relative basic strength of amines (aliphatic and aromatic). Intermolecular and intramolecular forces, hydrogen bonding. Effect of intermolecular and intramolecular forces on properties such as solubility, vapour pressure, melting and boiling points of organic compounds.

Module II

Stereochemistry

Conformational analysis of ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). IUPAC conventions for optical isomers: Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature.

Module III

Grignard reagent; preparation and uses, Alcohols; ethanol, propanol, glycerol; Monocarboxylic acids and their simple derivatives, descriptive studies of dicarboxylic acids, viz. malic, oxalic, tartaric, maleic, General methods of preparation of aliphatic aldehydes and ketones, Keto-enol tautomerism; aceto-acetic ester and malonic ester.

Module IV

Petroleum: Fractionation, cracking and synthetic petrol. General methods of preparation and properties of alkanes, alkenes, alkynes, Halo alkanes (CH_2Cl_2 , CHCl_3 , CCl_4 , CHI_3), Electrophilic substitutions in aromatic systems. General study of Cycloalkanes

Module V

Radioactive disintegration series, group displacement law, law of radioactive decay, half-life and average life of radio elements, radio active equilibrium, measurement of radioactivity. Stability of atomic nucleus, n/p ratio, Radioisotopes and their applications: Determination of age of earth, radio carbon dating, Medicinal and agriculture use of isotopes, hazards of radio activity.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Bahl, B. S. (2006). Text Book of Organic Chemistry 18th Ed. S. Chand & Co. Ltd.
2. Puri, B. R., Sharma, L. R., & Madan, S. P. (2013). Principles of Physical Chemistry. 46th Ed. Vishal Publishing Co.
3. Bahl, A. (2010). Advanced organic chemistry. 3rd Ed. S Chand & Company Limited.
4. I.L. Finar & S, Pearsons (1973). Organic Chemistry Vol.I & II 6th Ed. Pearson India.
5. N, Haider. (2011), Fundamentals of Organic Chemistry 5th Ed. S. Chand & Co. Ltd.
6. T. W. Graham Solomons. Organic Chemistry, John Wiley and Sons.

Bacteriology & Virology Lab.

Course Code: BSM 221

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 201

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Mycology & Phycology Lab.

Course Code: BSM 222

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 202

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Chemistry – II Lab.

Course Code: BSM 224

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 204

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

ENGLISH-II

Course Code: BCS 201

Credit Unit: 01

Course Objective:

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

Course Contents:

Module I: Vocabulary

Use of Dictionary

Use of Words: Diminutives, Homonyms & Homophones

Module II: Essentials of Grammar - I

Articles

Parts of Speech

Tenses

Module III: Essentials of Grammar - II

Sentence Structure

Subject -Verb agreement

Punctuation

Module IV: Communication

The process and importance

Principles & benefits of Effective Communication

Module V: Spoken English Communication

Speech Drills

Pronunciation and accent

Stress and Intonation

Module VI: Communication Skills-I

Developing listening skills

Developing speaking skills

Module VII: Communication Skills-II

Developing Reading Skills

Developing writing Skills

Module VIII: Written English communication

Progression of Thought/ideas

Structure of Paragraph

Structure of Essays

Module IX: Short Stories

Of Studies, by Francis Bacon

Dream Children, by Charles Lamb

The Necklace, by Guy de Maupassant

A Shadow, by R.K.Narayan

Glory at Twilight, Bhabani Bhattacharya

Module X: Poems

All the Worlds a Stage

Shakespeare

To Autumn

Keats

O! Captain, My Captain.

Walt Whitman

Where the Mind is Without Fear

Rabindranath Tagore

Psalm of Life

H.W. Longfellow

Text & References:

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

Behavioural Science-II
(Problem Solving and Creative Thinking)

Course Code: BSS 203

Credit Unit: 01

Course Objective:

To enable the students:

Understand the process of problem solving and creative thinking.

Facilitation and enhancement of skills required for decision-making.

Course Contents:

Module I: Thinking as a tool for Problem Solving

What is thinking: The Mind/Brain/Behaviour

Critical Thinking and Learning:

Making Predictions and Reasoning

Memory and Critical Thinking

Emotions and Critical Thinking

Thinking skills

Module II: Hindrances to Problem Solving Process

Perception

Expression

Emotion

Intellect

Work environment

Module III: Problem Solving

Recognizing and Defining a problem

Analyzing the problem (potential causes)

Developing possible alternatives

Evaluating Solutions

Resolution of problem

Implementation

Barriers to problem solving:

- Perception
- Expression
- Emotion
- Intellect
- Work environment

Module IV: Plan of Action

Construction of POA

Monitoring

Reviewing and analyzing the outcome

Module V: Creative Thinking

Definition and meaning of creativity

The nature of creative thinking

- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

The six-phase model of Creative Thinking: ICEDIP model

Module VI: End-of-Semester Appraisal

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

Examination Scheme:

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

Text & References:

- Michael S. (1999). How to be a Better Problem Solver, Kogan Page, New Delhi.
- Geoff P. (1999). How to be a Better at creativity; by: Kogan Page, New Delhi, (1999)
- Richard Y. C., & Keith P., (1998). Wheeler Publishing, New Delhi.
- Phil Lowe Koge (1996). Page: Creativity and Problem Solving, New Delhi,
- Pfeiffer, J. W., (1996). Theories and Models in Applied Behavioural Science, Management Pfeiffer & Company.
- Bensley, A. D. (1998). Critical Thinking in Psychology – A Unified Skills Approach, Brooks/Cole Publishing Company.

FRENCH - II

Course Code: FLT 201

Credit Unit: 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 201

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

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 201

Credit Unit : 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
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Weightage (%)	20	20	20	20	15	5
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C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- Español, En Directo I A
- Español Sin Fronteras

CHINESE – II

Course Code: FLC 201

Credit Unit: 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, wai 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



Program Name: B.Sc. (Hons.) MICROBIOLOGY

THIRD SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 301	Microbial Physiology & Metabolism	CC	3	-	-	3
BSM 302	Molecular Biology & RDT	CC	3	1	-	4
EVS 003	Environmental Sciences	CC	3	1	-	4
BSM 321	Biochemistry & Microbial Physiology Lab.	CC	-	-	4	2
BSM 322	Molecular Biology & RDT Lab.	CC	-	-	4	2
Domain Elective-I : Choose any one from the following courses						
BSM 311	Bionanotechnology & Biosensors	DE	3	-	-	3
BSM 312	Soil Microbiology					
BSM 313	Food Biotechnology					
BSM 314	Cell Biology					
Minor Track- II		MT				3
BSM 330	Term Paper Evaluation	NTCC	-	-	-	3
BCS 301	Communication Skills – I	VA	-	-	-	1
BSS 303	Behavioural Science-III (Interpersonal Communication & Relationship Management)	VA	-	-	-	1
FLT 301 FLG 301 FLS 301 FLC 301	Foreign Language – III French German Spanish Chinese	VA	-	-	-	2
AND003	Anandam-III	NTCC	2	-	-	2
TOTAL						30

Microbial Physiology & Metabolism

Course Code: BSM 301

Credit Units: 03

Course Objective: -

Objective of this course is to make students familiar with microbial physiology and its metabolism in detail.

Module I: - Nutritional Diversity of Microbes

Nutrition: Nutritional diversity & requirements of Microorganisms – Autotrophs, Heterotrophs, Photoautotrophs, Chemoautotrophs, Copiotrophs, Oligotrophs. Nutritional Transport Mechanisms, Diffusion: Passive and facilitated, Primary active and secondary active transport, Group translocation (phosphotransferase system), symport, antiport and uniport, electrogenic and electro neutral transport, transport of Iron. Phagocytosis – Pinocytosis.

Module II: - Microbial Growth

Different phases of growth – Growth curve – Generation time – Batch Growth, Continuous Growth, Fed Batch Growth, Synchronous culture, Diauxic growth, Factors influencing Microbial growth – Temperature, pH, Pressure, Salt concentration. Measurement of cell numbers, cell mass and metabolic activity, Ageing, death & Stress response in microorganism

Module III: - Metabolism & Energetics

EMP – HMP – ED pathways – TCA cycle- Electron transport chain – Oxidative and Substrate level phosphorylation, Uncouplers, inhibitors and ionophores. Chemical coupling, conformational coupling and chemiosmotic hypotheses. Methanogens

Module IV: - Anaerobic respiration

Anaerobic respiration – sulphur, nitrogenous compounds and CO₂ as final electron Acceptor - Fermentation – alcoholic, propionic and mixed acid fermentation. Lactic acid fermentation.

Module V: Photosynthesis

Microbial pigments for photosynthesis, Photosynthesis – Oxygenic and Anoxygenic , Carbon dioxide fixation, Bioluminescence.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.
2. David White. The Physiology and Biochemistry of Prokaryotes. Oxford University Press. 4th Edition. 2011.
3. Tortora, Funke and Case. Microbiology - An Introduction. Books a la carte Edition. 11th Edition
4. Doelle. H.W.1975.Bacterial Metabolism. 2nd edition. Academic Press.
5. Moat. A.G. J.W.Foster. 1988. Microbial physiology. 2nd edition. Springer – Verlag.
6. Caldwell. D.R.1995, Microbial physiology and Metabolism. WmC Brown Publishers, England.

Molecular Biology & RDT

Course Code: BSM 302

Credit Units: 04

Course Objective: -

The course will introduce students about basics of DNA, RNA and protein biology as well as introduce them with the genetic engineering tools

Module I: - Genetic Information

Genetic material, DNA as the carrier of genetic information, Key experiments establishing-The Central Dogma, DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, cot curves, RNA type and structure, RNA as genetic material in viruses

Module III: - DNA Mutation & Repair

Replication Errors, DNA Damage and their repair. Suppression of mutations, Ames test

Module II: - The Replication of DNA (Prokaryotes and Eukaryotes)

Experiments on semiconservative replication, bidirectional replication, mechanism of replication, requirement of RNA priming, enzymes & proteins involved in replication., Various models of DNA replication including rolling circle, D-loop (mitochondrial), Θ (theta) mode of replication, replication of linear ds-DNA, replicating the 5' end of linear chromosome.

Module III: - Transcription

RNA Polymerase and the transcription unit, Transcription in Prokaryotes & Eukaryotes
RNA Modifications, Split genes- concept of introns and exons, removal of Introns, alternative splicing, exon shuffling, RNA editing, and mRNA transport.

Module IV: - Translation

Genetic code, ribosome structure & translation, mechanism of translation on prokaryotes & eukaryotes, Fidelity of translation, Inhibitors of protein synthesis, introduction of protein trafficking

Module V: - Genetic Engineering- I

Milestones in genetic engineering, hosts for genetic engineering- *E. coli* strains; Yeast (*Saccharomyces cerevisiae*, *Pichia pastoris*); Fungi(*Penicillium*, *Aspergillus*); Mammalian cell lines - names and genotypes, Enzymes- Restriction modification systems: Types I, II and III. Mode of action, applications, DNA modifying enzymes and their applications: Terminal deoxynucleotidyltransferase, kinases and phosphatases, DNA ligases and DNA polymerases, reversetranscriptases, bacteriophage RNA polymerases, exonuclease III, BAL31, mungbean nuclease, S1 nuclease

Vectors- Properties, Plasmid vectors-pBR and pUC series,Bacteriophage lambda and M13 based vectors. Cosmids. Shuttle vectors. BACs,YACs, MACs Mammalian Expression Vectors- SV40, Vaccinia, Retroviral promoter based vectors

Module V: - Genetic Engineering- II

Steps of making recombinant DNA constructs for cloning & expression, *E. coli* expression vectors- lac, tac and T7 promoter based vectors. Yeast expression vectors- pET yeast vectors, YIp, YEp and YCp vectors. Baculovirus based vectors. Tibased vectors (Binary and Cointegrated vectors) and cloning using linkers and adaptors, Transformation of DNA by chemical method and electroporation, Methods of gene delivery in plants and animals- Microinjection, biolistic method (gene gun), liposome and viral-mediated delivery, Agrobacterium-mediated delivery

Few examples of RDT products in market

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.

3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) *Molecular Biology of the Gene* (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.
5. Alcamo IE. (2001). *DNA Technology: The Awesome Skill*. 2nd edition. Elsevier Academic Press, USA.
6. Brown TA. (2006). *Gene Cloning and DNA Analysis*. 5th edition. Blackwell Publishing, Oxford, U.K.
7. Clark DP and Pazdernik NJ. (2009). *Biotechnology-Appling the Genetic Revolution*. Elsevier Academic Press, USA.
8. Glick BR and Pasternak JJ. (2003). *Molecular Biotechnology*. 3rd edition. ASM Press Washington D.C.
9. Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7th edition. Blackwell Publishing, Oxford, U.K.
10. Sambrook J, Fritsch EF and Maniatis T. (2001). *Molecular Cloning-A Laboratory Manual*. 3rd edition. Cold Spring Harbor Laboratory Press.

Environmental Sciences

Course Code: EVS 003

Credit Units: 04

Course Objective: -

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

Course Contents:

Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness

Module II: Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module III: Ecosystems

Concept of an ecosystem

Structure and function of an ecosystem

Producers, consumers and decomposers

Energy flow in the ecosystem

Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Module IV: Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

Biodiversity at global, national and local levels

India as a mega-diversity nation

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts

Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Module V: Environmental Pollution

Definition

□□□ Causes, effects and control measures of:

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies.

Disaster management: floods, earthquake, cyclone and landslides.

Module VI: Social Issues and the Environment

From unsustainable to sustainable development

Urban problems and related to energy

Water conservation, rain water harvesting, watershed management

Resettlement and rehabilitation of people; its problems and concerns. Case studies.

Environmental ethics: Issues and possible solutions

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Case studies.

Wasteland reclamation

Consumerism and waste products

Environmental Protection Act

Air (Prevention and Control of Pollution) Act

Water (Prevention and control of Pollution) Act

Wildlife Protection Act

Forest Conservation Act

Issues involved in enforcement of environmental legislation

Public awareness

Module VII: Human Population and the Environment

Population growth, variation among nations

Population explosion – Family Welfare Programmes

Environment and human health

Human Rights

Value Education

HIV / AIDS

Women and Child Welfare

Role of Information Technology in Environment and Human Health

Case Studies

Module VIII: Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill/ mountain.

Visit to a local polluted site – Urban / Rural / Industrial / Agricultural

Study of common plants, insects, birds

Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text &References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
- Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
- Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
- Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
- Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
- Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
- Wanger K.D., 1998 Environnemental Management. W.B. Saunders Co. Philadelphia, USA 499p

Biochemistry & Microbial Physiology Lab.

Course Code: BSM 321

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 301

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Molecular Biology & RDT Lab.

Course Code: BSM 322

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 302

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Bionanotechnology& Biosensors

Course Code: BSM 311

Credit Units: 03

Course Objective: -

The aim of this paper is to explain nanomaterials & biosensors and their applications in various industries including Agricultural, Pharmaceutical etc.

Module I

Introduction and Definition, about Bionanomachines, Molecular Bionanotechnology. History of Bionanotechnology; Richard Feynman and his contributions. Biotechnology versus Bionanotechnology. Natural Bionanomachines.

Module II

Structural Principles of Bionanotechnology-Environment in which the Bionanomachines Functions. Principles behind design of Natural Bionanomachines- Covalent bonding, Dispersions and repulsion forces. Hydrogen bonding, Electrostatic Interaction, Hydrophobic effect. Hierarchical strategy in construction of Bionanomachines - Selfassembly, Self- organization. Concept of Molecular recognition.

Module III

Functional Principles of Bionanotechnology- Information storage- Nucliec acid, Ribosomes as assembler to construct proteins. Energetics- Energy from Light, electron transport pathways, electrochemical gradient. Biocatalysts- Enzymes and its regulation. Biomaterials. Biomolecular motors.

Module IV

Tools and technique required for Bionanotechnology- Recombinant DNA technology; site directed mutagenesis, Fusion proteins. X-Ray Crystallography, NMR, Electron Microscopy, Atomic force Microscopy. Bioinformatics- Molecular Modeling, Docking, Computer assisted Molecular design.

Module V

Applications of Bionanotechnology- Nanomedicines; Immunotoxins, Liposomes as drug carriers, Gene therapy, Personalised Medicines; Lab on chip concept. DNA Computers, Artificial Life, Hybrid materials,

Molecular sensing- Biosensors, Definitions, history and market needs, Sensors based on: enzymes, affinity and whole cells. Transducers: electrodes, photometric and acoustic, Signal processing. Case studies: immunosensors. Novel transducers and synthetic receptors. Clinical, environmental, industrial and military applications.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Goodsell - Bionanotechnology
2. Parag Diwan and Asish Bharadwaj, . - Nanomedicines Pentagon Press, 2006.
3. Vladimir P Torchilin, Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University, USA. 2006
4. Challa S.S.R. Kumar (Ed.). 2006. Biological and Pharmaceutical nonmaterial's Wiley- VCH Verlag Gmbh and Co., KgaA.
5. K.K. Jain 2006 Nanobiotechnology in Molecular Diagnostics: Current Techniques and Applications Horizon Biosciences.
6. Niemeyer, C.M. Mirking C.A., (Eds.) 2004. Nono biotechnology concepts.

Soil Microbiology

Course Code: BSM 312

Credit Units: 03

Course Objective: -

The course aims to introduce to the students one of the microbial residents of the soil and their effect on soil health

Module I

Soil environment, soil, structure, physico chemical characteristics, microbial composition and influence of soil and environmental factors on soil microflora .Quantitative and qualitative estimation of microorganisms in soil. Organic matter decomposition, Methanogenesis Humus formation.

Module II

Major biogeochemical cycles and the organisms. Microbial transformation of carbon-nitrogen-phosphorus and sulphur. Microbes in composting and biogas production

Module III

Microorganisms in soil fertility. Rhizosphere concept, R:S ratio, Interaction between plant and rhizosphere flora. Growth promoting rhizobacteria, soil enzymes, Biocheleters (siderophore).

Module IV

Biological nitrogen fixation Nitrogenase enzyme, nif genes symbiotic, nitrogen fixation (Rhizobia, Frankia), non symbiotic nitrogen fixation (Azotobacter, Azospirillum).VAM ecto-endo-ectendo-mycorrhizae.

Module V

Plant growth promoting bacteria, Biofertilizers productions, biopesticide production, soil nutrients formulations. Soil Tailoring and Possible Mitigation. Microbial Rehabilitation of degraded lands.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Soil Microbiology; An exploratory approach by Mark.s.coyne
2. Introduction to soil microbiology by Martin Alexander
3. Soil microorganisms and plant growth by N.S. Subba Rao
3. Soil microorganisms and plant growth by Somani.L.L and Bhandari, S.C

Food Biotechnology

Course Code: BSM 313

Credit Units:03

Course Objective:

This course will provide a broad grounding in concepts, techniques and issues involved in food products and their processing.

Course Contents:

Module I: Introduction

Scope and importance of food industry; RDT and other technologies involved in development of food products; Concept of 'functional food'; Advances and trends, ethical issues, quality control, legislation, FDA & FPO (India), patenting processes and products, consumer acceptance scenario for GM food products and GM crops.

Module II: Techniques used in Food Industry

Sterilization, isolation, screening and strain improvement, cell harvesting and disruption, recovery and purification, production of organic acids – citric acid, lactic acid and acetic acid; Gene cloning, production of recombinant proteins e.g. chymosin

Module III: Dairy Biotechnology

Starter cultures, prebiotics, probiotics – their use as flavor enhancers and disease/ infection combats, applications in production of cheese, butter, ice-cream, yoghurt; applications in biomedical research, e.g. recombinant LABs as vaccines; Modified milk proteins.

Module IV: Microbial, Plant and Animal Biotechnology

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

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text & References:

Text:

- Food Biotechnology - 2. 1988. R.D. King and P.S.J. Cheetham (Eds.). Elsevier Applied Science, NY.

References:

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

Cell Biology

Course Code: BSM 314

Credit Units: 03

Course Objective:-

The objective of this course is to provide a conceptual frame work for dealing with the evolving understanding of cell. The students will learn about cell as a unit of living systems, its various organelles, their structure, function and metabolic processes.

Module II: - Protein Sorting and Transport

The Endoplasmic reticulum, The Golgi Apparatus, Mechanism of Vesicular Transport, Lysosomes, Transport of small molecules across plasma membrane, Endocytosis

Module II: -The Cell Cycle

Eukaryotic Cell Cycle, Regulation of Cell cycle progression, Events of Mitotic Phase, Meiosis and Fertilization.

Module III: - Cell Signaling

Signaling molecules and their receptor; functions of cell surface receptors; Intracellular signal transduction pathway; signaling networks.

Module IV: - Cell Death and Cell Renewal

Programmed Cell Death, Stem Cells and Maintenance of adult tissues, Embryonic Stem Cells and Therapeutic cloning.

Module V: - Cancer

Development and Causes of Cancer, Tumor Viruses, Oncogenes, Tumor Suppressor genes, Cancer Treatment- molecular approach.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
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Weightage (%)	15	10	10	10	5	50
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Text and Reference Books:-

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

Communication Skills - I

Course Code: BCS 301

Credit Units: 01

Course Objective:

To form written communication strategies necessary in the workplace

Course Contents:

Module I: Introduction to Writing Skills

Effective Writing Skills

Avoiding Common Errors

Paragraph Writing

Note Taking

Writing Assignments

Module II: Letter Writing

Types

Formats

Module III

Memo

Agenda and Minutes

Notice and Circulars

Module IV: Report Writing

Purpose and Scope of a Report

Fundamental Principles of Report Writing

Project Report Writing

Summer Internship Reports

Examination Scheme:

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

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

Text & References:

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

Behavioural Science-III

(Interpersonal Communication & Relationship Management)

Course Code: BSS 303

Credit Units: 01

Course Objective:

This course aims at imparting an understanding of: Interpersonal communication and relationship. Strategies for healthy interpersonal relationship Effective management of emotions. Building interpersonal competence.

Course Contents:

Module I: Interpersonal Communication

Importance of Behavioural/ Interpersonal Communication

Types – Self and Other Oriented

RapportBuilding – NLP, Communication Mode

Steps to improve Interpersonal Communication

Module II: Interpersonal Styles

Transactional Analysis

Life Position/Script Analysis

Games Analysis

Interact ional and Transactional Styles

Bridging differences in Interpersonal Relationship through TA

Communication Styles

Module III: Conflict Management and Negotiation

Meaning and Nature of conflicts

Styles and techniques of conflict management

Meaning of Negotiation

Process and Strategies of Negotiation

Interpersonal Communication: Conflict Management and Negotiation

Module IV: Interpersonal Relationship Development

Importance of Interpersonal Relationships

Interpersonal Relationship Skills

Types of Interpersonal Relationships

Relevance of Interpersonal Communication in Relationship Development

Module V: Impression Management

Meaning & Components of Impression Management

Impression Management Techniques

Impression Management Training-Self help and Formal approaches

Module VI: End-of-Semester Appraisal

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

Text & References:

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.
- Rosenfeld, P., Giacalone, R.A. and Catherine, A.R. (2003). Impression Management: Building and Enhancing Reputations at Work. Thomson Learning, Singapore.

FRENCH - III

Course Code: FLT 301

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 restau
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)
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: FLG 301

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

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: FLS 301

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
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Weightage (%)	20	20	20	20	15	5
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C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- Español, EnDirecto I A
- Español Sin Fronteras -Nivel Elemental

CHINESE – III

Course Code: FLC 301

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 “hui” 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, meinian 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

Term Paper (Evaluation)

Course Code: BSM 330

Credit Units: 03

Course objectives

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject.

The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

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

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

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

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

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

- a) Get facts, not just opinions. Compare the facts with author's conclusion.
- b) In research studies, notice the methods and procedures, results & conclusions.
- c) Check cross references.

4. Outlining the paper

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

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

- a) statement of purpose
- b) main body of the paper
- c) statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main idea.

6. Editing & preparing the final Paper

- a) Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
- b) Read the paper to ensure that the language is not awkward, and that it "flows" properly.
- c) Check for proper spelling, phrasing and sentence construction.
- d) Check for proper form on footnotes, quotes, and punctuation.
- e) Check to see that quotations serve one of the following purposes:
 - (i) Show evidence of what an author has said.

- (ii) Avoid misrepresentation through restatement.
- (iii) Save unnecessary writing when ideas have been well expressed by the original author.
- f) Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

Term papers should be composed of the following sections:

- 1) [Title page](#)
- 2) [Table of contents](#)
- 3) [Introduction](#)
- 4) Review
- 5) [Discussion](#) & [Conclusion](#)
- 6) [References](#)
- 7) [Appendix](#)

Generally, the introduction, discussion, conclusion and bibliography part should account for a third of the paper and the review part should be two thirds of the paper.

Discussion

The discussion section either follows the results or may alternatively be integrated in the results section. The section should consist of a discussion of the results of the study focusing on the question posed in the research paper.

Conclusion

The conclusion is often thought of as the easiest part of the paper but should by no means be disregarded. There are a number of key components which should not be omitted. These include:

1. summary of question posed
2. summary of findings
3. summary of main limitations of the study at hand
4. details of possibilities for related future research

References

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

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography.

The key to a good bibliography is consistency. Choose a particular convention and stick to this.

Conventions

Monographs

Crystal, D. (2001), *Language and the internet*. Cambridge: Cambridge University Press.

Edited volumes

Gass, S./ Neu, J. (eds.) (1996), *Speech acts across cultures. Challenges to communication in a second language*. Berlin/ NY: Mouton de Gruyter.

[(eds.) is used when there is more than one editor; and (ed.) where there is only one editor. In German the abbreviation used is (Hrsg.) for Herausgeber].

Edited articles

Schmidt, R./Shimura, A./Wang, Z./Jeong, H. (1996), *Suggestions to buy: Television commercials from the U.S., Japan, China, and Korea*. In: Gass, S./Neu, J. (eds.) (1996), *Speech acts across cultures. Challenges to communication in a second language*. Berlin/ NY: Mouton de Gruyter: 285-316.

Journal articles

McQuarrie, E.F./Mick, D.G. (1992), *On resonance: A critical pluralistic inquiry into advertising rhetoric*. *Journal of consumer research* 19, 180-197.

Electronic book

Chandler, D. (1994), *Semiotics for beginners* [HTML document]. Retrieved [5.10.'01] from the World Wide Web, <http://www.aber.ac.uk/media/Documents/S4B/>.

Electronic journal articles

Watts, S. (2000) Teaching talk: Should students learn 'real German'? [HTML document]. German as a Foreign Language Journal [online] 1. Retrieved [12.09.'00] from the World Wide Web, <http://www.gfl-journal.com/>.

Other websites

Verterhus, S.A. (n.y.), Anglicisms in German car advertising. The problem of gender assignment [HTML document]. Retrieved [13.10.'01] from the World Wide Web, <http://olaf.hiof.no/~sverrev/eng.html>.

Unpublished papers

Takahashi, S./DuFon, M.A. (1989), Cross-linguistic influence in indirectness: The case of English directives performed by native Japanese speakers. Unpublished paper, Department of English as a Second Language, University of Hawai'i at Manoa, Honolulu.

Unpublished theses/ dissertations

Möhl, S. (1996), Alltagssituationen im interkulturellen Vergleich: Realisierung von Kritik und Ablehnung im Deutschen und Englischen. Unpublished MA thesis, University of Hamburg.

Walsh, R. (1995), Language development and the year abroad: A study of oral grammatical accuracy amongst adult learners of German as a foreign language. Unpublished PhD dissertation, University College Dublin.

Appendix

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

Assessment Scheme:

Continuous Evaluation

40%

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

Final Evaluation

60%

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



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

FOURTH SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 401	Immunology	CC	3	1	-	4
BSM 402	Fermentation Technology & Industrial Microbiology	CC	3	-	-	3
BSM 403	Medical Microbiology	CC	3	-	-	3
BSM 421	Immunology & Medical Microbiology Lab.	CC	-	-	4	2
BSM 422	Fermentation Technology & Industrial Microbiology Lab.	CC	-	-	4	2
Domain Elective-II: Choose any one from the following courses						
BSM 411	Bioinformatics	DE	3	-	-	3
BSM 412	Pharmaceutical Technology & Microbiology					
BSM 413	Biomaterial Science					
BSM 414	Inheritance Biology					
Minor Track- III		MT				3
BCS 401	Communication Skills – II	VA	-	-	-	1
BSS 403	Behavioural Science-IV (Group Dynamics and Team Building)	VA	-	-	-	1
FLT 401 FLG 401 FLS 401 FLC 401	Foreign Language – IV French German Spanish Chinese	VA	-	-	-	2
AND 004	Anandam-IV	NTCC	2	-	-	2
TOTAL						26

Note: - Students will be required to undergo summer training of 45 days in industry/ research institution/ academic institution. Work progress will be evaluated in V semester.

Immunology

Course Code: BSM 401

Credit Units: 04

Course Objective:-

The aim to teach immunology and immuno technology is to make better understanding of immune system, types and mechanism, immune responses, their tolerance and suppression as well as tools and techniques involved in diagnosis and identification of related diseases.

Module I: - Introduction

Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Louis Pasteur, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa, Concept of Innate and Adaptive immunity

Module II: - Immune Cells and Organs

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell, NKT cells; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

Antigens Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants

Antibodies Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies

Module III: - Major Histocompatibility Complex & Complement System

Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways)

Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement activation

Module IV: - Generation of Immune Response

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Costimulatory signals); Killing Mechanisms by CTL and NK cells, Self tolerance.

Module V: - Immunological Disorders and Tumor Immunity

Types of Autoimmunity and Hypersensitivity with examples; Immunodeficiencies - Animal models (Nude and SCID mice), SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD; Characteristics of tumor antigens.

Module VI: - Immunological Techniques

Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry, Immunoelectron microscopy, RIST, RAST, MLR., Vaccines- general principle & types

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Fermentation Technology & Industrial Microbiology

Course Code: BSM 402

Credit Units: 03

Course Objective:-

The objective of course is to explain fermentation processes and its bi-product, their industrial uses and recent advances.

Module I: - Introduction

Brief history and developments in Fermentation Technology & Industrial Microbiology, Primary and secondary screening, strain development, Typical composition & characteristics of industrial fermentation media, Crude and synthetic media; molasses, corn-steep liquor, sulphite waste liquor, whey and yeast extract

Module II: - Fermentation processes & Instrumentation

Solid-state and liquid-state (stationary and submerged) fermentations; Batch, fedbatch and continuous fermentations, Components of a typical bioreactor, types of bioreactors-Laboratory, pilot- scale, and production fermenters; constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.

Module III: - Measurement and control of fermentation parameters

Monitoring and control of pH, temperature, dissolved oxygen, foaming and aeration during fermentation

Module IV: - Down-stream Processing

Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying

Module V: - Microbial production of industrial products

Citric acid, ethanol, vinegar, penicillin, glutamic acid, riboflavin, enzymes (amylase, cellulase, protease, lipase, glucose isomerase, glucose oxidase), wine, beer, bioinsecticides (Bt) and Steroid transformations

Module VI: - Enzyme & Cell immobilization

Methods of immobilization, advantages and applications of immobilization, Applications of immobilized enzymes & cells

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

Medical Microbiology

Course Code: BSM 403

Credit Units: 03

Course Objective:-

Aim of the course is to make the students familiar with diagnostic and public health microbiology, modern techniques for the identification of pathogens in diagnostic laboratories and antimicrobial chemotherapy in patient care.

Module I: Introduction& Diagnostics

Normal microflora of the human body- Skin, throat, gastrointestinal tract, urogenital tract, Collection, transport and culturing of clinical samples, principles of different diagnostic tests (Culture, microscopy, ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes).

Module II: - Host-pathogen interactions

Infection sources & transmission, Entry of pathogens into the host, types of bacterial pathogens, Mechanism of bacterial pathogenicity, colonization and growth, Virulence, Virulence factors – exotoxins, enterotoxins, endotoxins, neurotoxins. – avoidance of host defense mechanisms, damage to host cell, Host factors for infection and innate resistance to infection opportunistic infections, septicemia, septic shock, systemic infection

Module III: - Bacterial diseases (symptoms, pathogenesis, transmission, diagnosis, treatment prophylaxis and control)

Bacillus anthracis, Corynebacterium diphtheriae, Streptococcus pyogenes, Escherichia coli, Salmonella typhi and paratyphi, Shigella dysenteriae, Helicobacter pylori, Vibrio cholerae, Haemophilus influenza, Neisseria gonorrhoeae, Mycobacterium tuberculosis, Treponema pallidum

Module IV: - Viral diseases (symptoms, pathogenesis, transmission, diagnosis, treatment, prophylaxis and control), Introduction protozoan & fungal diseases

Polio, Chicken pox, Herpes, Hepatitis, Rabies, Influenza with brief description of bird and swine flu, Dengue, AIDS, Viral cancers. An overview of emerging viral diseases: Japanese Encephalitis, Ebola, Marburg, SARS, Hanta, Nipah, Chandipura, Chikungunya.

Malaria, Kala-azar, and Toxoplasmosis, aspergelosis and dermatomycoses

Module V: - Antimicrobial agents, drug resistance & Epidemiology of Infectious Diseases

Antibiotics, mechanism of action of important chemotherapeutic agents, Principles of drug resistance in bacteria

Principles of epidemiology, Current epidemics (AIDS, Nosocomical, Acute respiratory Syndrome) Measures for prevention of epidemics –Global health consideration, Emerging and reemerging infectious diseases Biological warfare and biological weapons.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Ananthanarayan R and Paniker CKJ. (2005). Textbook of Microbiology. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg’s Medical Microbiology. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims’ Medical Microbiology. 4th edition. Elsevier.
4. Joklik WK, Willett HP and Amos DB (1995). Zinsser Microbiology. 19th edition. Appleton-Centuary-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein’s Microbiology. 7th edition. McGraw Hill Higher Education.

Immunology & Medical Microbiology Lab.

Course Code: BSM 421

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 401 & BSM 403

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Fermentation Technology & Industrial Microbiology Lab.

Course Code: BSM 422

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 402

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Bioinformatics

Course Code: BSM 411

Credit Units: 03

Course Objective:-

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

Module I: -

Scope of Bioinformatics and internet basics. Database management system: Data life cycle, Database architecture, Data format, Database abstraction, relational database system. Database searching: Protein sequence databases, genome databases, protein structure databases, conserved sequence databases, literature databases, BLAST and its types.

Module II: -

Sequences and their alignment: Meaning of sequence, sequence similarity, homology. Pairwise Sequence Alignment: Different scoring models, Substitution matrices (PAM and BLOSUM), Concept of Global and Local Alignment, Dot matrix method, Dynamic programming (Needleman-Wunsch algorithm, SmithWaterman algorithm), Choosing of best scoring matrix, gap penalties, BLAST (Word) algorithms.

Module III: -

Multiple Sequence alignment: Multiple Sequence Alignment methods (MSA), Progressive, Iterative and Hidden Markov Model (HMM) methods of MSA. Whole genome assemblies, optical mapping, whole genome comparisons, Phylogenetic Analysis

Module IV: -

Electronic journals: importance of E-journals and their features like electronic submission, downloading, reference and citations.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. D.W. Mount Bioinformatics: Genome and Sequence Analysis: (2001) Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
2. D. Higgins and Willie Taylor. Bioinformatics: Sequences, structures and databanks. Oxford.
3. A.D. Baxevanis and B.F. Francis Ouellette. Bioinformatics: A practical guide to the analysis of genes and proteins

PHARMACEUTICAL TECHNOLOGY & MICROBIOLOGY

Course Code: BSM 412

Credit Units: 03

Theory

Course Objective:

The main objectives for biotechnology students 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

Module –I:

Pharmaceutical calculations: Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.

Pharmacopoeias & Formularies: IP,BP,USP, Drug & cosmetic act and rules, Good manufacturing practices, Good laboratories practices and requirements of premises, plant and equipment for pharmaceutical products including Master & Batch formula records. (Schedule-M).

Module-II

Pharmaceutical Dosage Forms & Drug Delivery Systems:

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

Module III

Pharmaceutical Microbiology:

Disinfection: Classification, mode of action, factors influencing disinfectants, uses, evaluation and effectiveness.

Sterilization: Introduction, significance, sensitivity of microorganisms, detailed methods for sterilization processes. Sterilization control and sterility assurance. Sterility testing of pharmaceutical products as per pharmacopoeial standards.

Microbiological assays of antibiotics, vitamins, amino acids, Microbial limit tests for Pharmaceutical dosage forms

Module-IV

Antibiotics: Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Classification of antimicrobial drugs based on mechanism of action. Problems arising with use of Antimicrobial drugs (Toxicity, Hypersensitivity reactions, Drug resistance, Super-infection, Nutritional deficiencies.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Suggested Books:

1. Pharmaceutical Biotechnology, by Daan J. A. Crommelin, Robert D. Sindelar. Informa Healthcare USA, Inc, 3rd edition.
2. Textbook of Pharmaceutical Biotechnology, By Chandrakant Kokate, Pramod H.J, SS Jalalpure , Publisher: Elsevier India Pvt Ltd.
3. Vyas SP, Dixit VK.”Pharmaceutical Biotechnology”, 1st edition ,2007, CBS Publishers & Distributors, New Delhi
4. Textbook Of Physical Pharmaceutics by C.V.S. Subrahmanyam, Vallabh Prakashan.
5. Text book of Pharmaceutical Engineering by C.V.S. Subrahmanyam, Vallabh Prakashan.

Biomaterial Science

Course Code: BSM 413

Credit Units: 03

Course Objective:-

The course will show examples of variety of biopolymers used in different biomedical applications.

Module I: - Classification, Chemistry and characterization of biomaterials

Definition and classification of bio-materials, Structure of bio-material: Metallic implant materials, stainless steels, Co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite glass ceramics, carbons.

Polymeric implant materials: definition of DP, CRU, Monomer, classification of polymers, polyolefin, polyamines, Acrylic, polymers, rubbers, high strength thermoplastics, PVC, HEMA, hydrogels. Nanomaterials: fullerenes, carbon nanotubes, nanomembranes. Synthesis of bio-materials, Characterization of chemical, physical, mechanical properties, visco elasticity, end group analysis, determination of molecular weight of a polymer.

Module II: - Biocompatibility

Biocompatibility of Bio-materials, wound-healing process, body response to implants, blood compatibility. Tests to assess biocompatibility of a polymer, modifications to improve biocompatibility. Reactions of biomaterials with cellular and extra cellular components

Module III: - Modified biomaterials

Biodegradative biomaterials, Bioactive polymers and biosynthetic polymers, inert biomaterials, genetically engineered biomaterials

Module IV: - Applications of Biomaterials

Tissue Replacement Implants, Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal Fractures fixation devices, joint replacements. Artificial

Organs, Artificial Heart, Prosthetic cardiac Valves, Limb prosthesis, Externally Powered limb, prosthesis, Dental Implants, Other applications, Liposomes, hydrogels and Nanomaterials in drug delivery. Biomaterials in diagnostics and bioanalytical techniques.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Sujata V. Bhat, Biomaterials , 2 nd edition, Narosa Publishing House, New Delhi, 2006.
2. Buddy D. Ratner, B. D. Ratner, Allan S. Hoffman, Biomaterials Science: An Introduction To Materials In Medicine, 2nd Edition(2004) Publisher: Academic Press.
3. Fred W. Billmeyer, Text book of Polymer Science. 3 rd edition John Wiley and sons publications.

Inheritance Biology

Course Code: BSM 414

Credit Units: 03

Course Objective:-

The objective of this course is to understand the Mendelian and nonmendelian modes of inheritance that govern passage of genetic traits across generation; to use this knowledge of inheritance to track alleles through generations and categorize and predict genotypes and phenotypes

Module I: - Introduction to Genetics

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information, Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex linked inheritance, sex determination

Module II: - Linkage, Crossing Over and Chromosomal Mapping

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping.

Module III: - Mutations

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy. Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations, Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method, DNA repair mechanisms.

Module IV: Extrachromosomal Inheritance Quantitative Genetics

Chloroplast mutation/Variation in Four o' clock plant and Chlymodomonas, Mitochondrial mutations in Neurospora and yeast, Maternal effects, Infective heredity- Kappa particles in Paramecium, Quantitative and multifactor inheritance, Transgressive variations, Heterosis.

Module V: - Population Genetics & Evolutionary Genetics

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift, Genetic variation and Speciation.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). VIII ed. Principles of Genetics. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition. Benjamin Cummings.
4. Russell, P. J. (2009). iGenetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
6. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.
7. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

Communication Skills -II

Course Code: BCS 401

Credit Units: 01

Course Objective:

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

Course Contents:

Module I: Social Communication Skills

Small Talk

Conversational English

Appropriateness

Building rapport

Module II: Context Based Speaking

In general situations

In specific professional situations

Discussion and associated vocabulary

Simulations/Role Play

Module III: Professional Skills

Presentations

Negotiations

Meetings

Telephony Skills

Examination Scheme:

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

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

Text & References:

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

Behavioural Science IV
(Group Dynamics and Team Building)

Course Code: BSS 403

Credit Units: 01

Course Objective:

To inculcate an elementary level of understanding of group/team functions

To develop team-spirit and to know the importance of working in teams

Course Contents:

Module I: Group formation

Definition and Characteristics

Importance of groups

Classification of groups

Stages of group formation

Benefits of group formation

Module II: Group Functions

External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.

Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.

Group Cohesiveness and Group Conflict

Adjustment in Groups

Module III: Teams

Meaning and nature of teams

External and Internal factors effecting team

Building Effective Teams

Consensus Building

Collaboration

Module IV: Leadership

Meaning, Nature and Functions

Self leadership

Leadership styles in organization

Leadership in Teams

Module V: Power to empower: Individual and Teams

Meaning and Nature

Types of power

Relevance in organization and Society

Module VI: End-of-Semester Appraisal

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

Text & References:

- Organizational Behaviour, Davis, K.
- Hoover, Judith D. Effective Small Group and Team Communication, 2002, Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

FRENCH - IV

Course Code: FLT 401

Credit Units: 02

Course Objective:

To enable students:

- To develop strategies of comprehension of texts of different origin
- To present facts, projects, plans with precision

Course Contents:

Module C: pp. 104 – 139 : Unités 8,9

Contenu lexical : Unité 8: Découvrir le passé

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

Unité 9: Entreprendre

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

Contenu grammatical:

1. Imparfait
2. Pronom « en »
3. Futur
4. Discours rapporté au présent
5. Passé récent
6. Présent progressif

Examination Scheme:

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

C – Project + Presentation

I – Interaction/Conversation Practice

Text & References:

- le livre à suivre : Campus: Tome 1

GERMAN - IV

Course Code: FLG 401

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 Advanced Grammar Language and Professional Jargon

Course Contents:

Module I: Present perfect tense

Present perfect tense, usage and applicability

Usage of this tense to indicate near past

Universal applicability of this tense in German

Module II: Letter writing

To acquaint the students with the form of writing informal letters.

Module III: Interchanging prepositions

Usage of prepositions with both accusative and dative cases

Usage of verbs fixed with prepositions

Emphasizing on the action and position factor

Module IV: Past tense

Introduction to simple past tense

Learning the verb forms in past tense

Making a list of all verbs in the past tense and the participle forms

Module V: Reading a Fairy Tale

Comprehension and narration

Rotkäppchen

Froschprinzessin

Die Fremdsprache

Module VI: Genitive case

Genitive case – Explain the concept of possession in genitive

Mentioning the structure of weak nouns

Module VII: Genitive prepositions

Discuss the genitive prepositions and their usage: (während, wegen, statt, trotz)

Module VIII: Picture Description

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

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 – IV

Course Code: FLS 401

Credit Units: 02

Course Objective:

To enable students acquire working knowledge of the language; to give them vocabulary, grammar, voice modulations/intonations to handle everyday Spanish situations with ease.

Course Contents:

Module I

Revision of earlier semester modules

Introduction to Present Continuous Tense (Gerunds)

Module II

Translation with Present Continuous Tense

Introduction to Gustar, Parecer, Apetecer, doler

Module III

Imperatives (positive and negative commands of regular verbs)

Module IV

Commercial/business vocabulary

Module V

Simple conversation with help of texts and vocabulary

En la recepcion del hotel

En el restaurante

En la agencia de viajes

En la tienda/supermercado

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 Sin Fronteras (Nivel – Elemental)

CHINESE – IV

Course Code: FLC 401

Credit Units:02

Course Objective:

How many characters are there? The early Qing dynasty dictionary included nearly 50,000 characters the vast majority of which were rare accumulated characters over the centuries. An educate person in China can probably recognize around 6000 characters. 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

Dialogue Practice

Observe picture and answer the question

Pronunciation and intonation

Character writing and stroke order.

Electronic items

Module II

Traveling – The Scenery is very beautiful

Weather and climate

Grammar question with – “bu shi Ma?”

The construction “yao ... le” (Used to indicate that an action is going to take place)

Time words “yiqian”, “yiwai” (Before and after).

The adverb “geng”.

Module III

Going to a friend house for a visit meeting his family and talking about their customs.

Fallen sick and going to the Doctor, the doctor examines, takes temperature and writes prescription.

Aspect particle “guo” shows that an action has happened some time in the past.

Progressive aspect of an actin “zhengzai” Also the use if “zhe” with it.

To welcome someone and to see off someone I cant go the airport to see you off... etc.

Module IV

Shipment. Is this the place to checking luggage?

Basic dialogue on – Where do u work?

Basic dialogue on – This is my address

Basic dialogue on – I understand Chinese

Basic dialogue on – What job do u do?

Basic dialogue on – What time is it now?

Module V

Basic dialogue on – What day (date) is it today?

Basic dialogue on – What is the weather like here.

Basic dialogue on – Do u like Chinese food?

Basic dialogue on – I am planning to go to China.

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-2” Lesson 31-38



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

FIFTH SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 501	Microbial Ecology & Diversity	CC	3	-	-	3
BSM 502	Microbial Genetics & Genomics	CC	3	-	-	3
BSM 503	Plant Pathology	CC	3	-	-	3
BSM 521	Microbial Ecology & Plant Pathology Lab.	CC	-	-	4	2
BSM 522	Microbial Genetics & Genomics Lab.	CC	-	-	4	2
Domain Elective-III: Choose any one from the following courses						
BSM 511	Industrial Safety & Management	DE	3	-	-	3
BSM 512	IPR & Bioethics					
BSM 513	GMP & Microbial Quality Control					
BSM 514	Clinical Research & Pharmacovigilance					
Minor Track- IV		MT				3
BSM 550	Summer Training Evaluation	CC	-	-	-	3
BCS 501	Communication Skills – III	VA	-	-	-	1
BSS 503	Behavioural Science-V (Individual, Society and Nation)	VA	-	-	-	1
FLT 501 FLG 501 FLS 501 FLC 501	Foreign Language – V French German Spanish Chinese	VA	-	-	-	2
AND 005	Anandam-V	NTCC	2	-	-	2
TOTAL						28

Microbial Ecology & Diversity

Course Code: BSM 501

Credit Units: 03

Course Objective: -

The syllabus has been designed to make students aware of the microbial interactions with environment. Also, the course deals with the application of various molecular techniques to study microbial ecology and effect of various biotechnological processes on microbes.

Module I: - Field of Microbial Ecology

Contributions of Beijerinck, Winogradsky, Kluver, Van Niel, Martin Alexander, Selman A. Waksman, terrestrial microflora, microflora of Freshwater & Marine habitats, aeromicroflora, Extremophiles: Microbes thriving at high & low, temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels

Module II: - Biological Interactions

Microbe–Microbe Interactions- Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation,

Microbe–Plant Interactions- Roots, Aerial Plant surfaces, Biological Nitrogen fixation (symbiotic/nonsymbiotic- biofertilizers)

Microbe–Animal Interactions- role of microbes in ruminants, nematophagous fungi, luminescent bacteria, symbiont

Module III: - Biogeochemical cycles

Carbon cycle- Microbial degradation of polysaccharide (cellulose, hemicellulose, lignin, chitin)

Nitrogen cycle- Ammonification, nitrification, denitrification & nitrate reduction

Phosphorous cycle- Phosphate immobilization and phosphate solubilization

Sulphur Cycle

Module IV: - Advances in Microbial Ecology

Structure & dynamics of microbial communities, diversity & Stability, population selection within communities, succession within microbial communities with one example, microbial adaptation to extreme environments

Classical and modern methods to study microbial diversity, Molecular Phylogenetics, 16s rRNA technique.

Bioleaching, Microbial deterioration of metals (corrosion), textile and paper

Module V: - Waste Management

Sources and types of solid waste, methods of disposal of solid waste (incineration, composting, sanitary landfill) Liquid Waste Management, Composition of sewage; strength of sewage (BOD and COD); Primary, secondary (aerobic – oxidation pond, trickling filter, rotating biological contractor/biodisc system, activated sludge process and anaerobic – septic tank, imhoff tank, anaerobic digester) and tertiary sewage treatment

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA.
2. Atlas RM. (1989). Microbiology: Fundamentals and Applications. 2nd Edition, MacMillan Publishing Company, New York.
3. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/ Benjamin Cummings.
4. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
5. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.

6. Lynch JM & Hobbie JE. (1988). *Microorganisms in Action: Concepts & Application in Microbial Ecology*. Blackwell Scientific Publication, U.K.
7. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.
8. Martin A. (1977). *An Introduction to Soil Microbiology*. 2nd edition. John Wiley & Sons Inc. New York & London.
9. Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.
10. Subba Rao NS. (1999). *Soil Microbiology*. 4th edition. Oxford & IBH Publishing Co. New Delhi.

Microbial Genetics & Genomics

Course Code: BSM 502

Credit Units: 03

Course Objective: -

The course will introduce students about genetic recombination and their applications, also give introduction of various genomics tools

Module I: - Introduction

DNA topology - linking number, topoisomerases, organization of chromosomes in prokaryotes and eukaryotes, organelle DNA- mitochondria and chloroplast, Plasmids- structure, types, replication, properties incompatibility, Transposons- types, function and mechanism of transposition, other repetitive DNA in genome

Module II: - Genetic Exchange

Transduction, Transformation and Conjugation, mechanisms of genetic recombination

Module III: - Genome Regulation

Principles of transcriptional regulation in prokaryotes, regulation at initiation with examples from lac and trp operons, Transcription regulation in eukaryotes, conserved mechanism of regulation, Eukaryotic activators, Signal integration, combinatorial control, transcriptional repressors, signal transduction and control of transcriptional regulator, Gene Silencing

Regulation of translation- translation-dependent regulation of mRNA and Protein Stability

Regulatory RNAs- Riboswitches, RNA interference, miRNA, siRNA

Cell signalling in prokaryotes, One-Two component regulatory system, quorum sensing

Global & heat shock response in bacteria, Stress response in bacteria

Module IV: - Genome, transcriptome and proteome analysis- I

Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot and colony hybridizations. Chromosome walking and jumping. DNA fingerprinting

by RFLP and RAPD. Gel retardation assays. DNA footprinting by DNase I, DNA

microarray analysis. SDS-PAGE and Western blotting. Phage display

Polymerase chain reaction – principle enzymes used, primer design, reverse transcriptase PCR, realtime PCR, colony PCR, LAMP

Module V: - Genome, transcriptome and proteome analysis- II

Genomic and cDNA libraries: Preparation and uses, Maxam-Gilbert's and Sanger's method.

Automated sequencing. Human genome sequencing project

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
4. Russell, P. J. (2009). *i*Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
6. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.
7. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.
8. Ghosh, Z. and Mallick, V. (2008). Bioinformatics-Principles and Applications. Oxford Univ. Press

Plant Pathology

Course Code: BSM 503

Credit Units: 03

Course Objective: -

It is an introductory course that offers a broad introduction to plant diseases and the organisms that cause them. The material focuses on the four interacting factors necessary for disease to occur: the pathogen, the host, the environment, and time.

Module I: - Introduction

Concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, economic losses and social impact of plant diseases. Significant landmarks in the field of plant pathology- Contributions of Anton DeBary, Millardet, Burrill, E. Smith, Adolph Mayer, Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank, molecular Kochs postulates. Contributions of eminent Indian plant pathologists.

Module II: - Host Pathogen Interactions & Defense Mechanisms

Infection, invasion, colonization, dissemination of pathogens and perennation. Virulence factors of pathogens: enzymes, toxins (host specific and nonspecific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction)

Concepts of constitutive defense mechanisms in plants, inducible structural defenses (histological-cork layer, abscission layer, tyloses, gums), inducible biochemical defenses [hypersensitive response (HR), systemic acquired resistance (SAR), phytoalexins, pathogenesis related (PR) proteins, plantibodies, phenolics, quinones, oxidative bursts].

Module III: - Epidemiology and Genetics of Plant Diseases

Concepts of monocyclic, polycyclic and polyetic diseases, disease triangle & disease pyramid, forecasting of plant diseases and its relevance in Indian context.

Concept of resistance (R) gene and avirulence (avr) gene; gene for gene hypothesis, types of plant resistance: true resistance– horizontal & vertical, apparent resistance.

Module IV: - Specific Plant diseases

Fungal Diseases

- _ White rust of crucifers - *Albugo candida*
- _ Downy mildew of onion - *Peronospora destructor*
- _ Late blight of potato - *Phytophthora infestans*
- _ Powdery mildew of wheat - *Erysiphe graminis*
- _ Ergot of rye - *Claviceps purpurea*
- _ Black stem rust of wheat - *Puccinia graminis tritici*
- _ Loose smut of wheat - *Ustilago nuda*
- _ Wilt of tomato - *Fusarium oxysporum* f.sp. *lycopersici*
- _ Red rot of sugarcane - *Colletotrichum falcatum*
- _ Early blight of potato - *Alternaria solani*

Bacterial Diseases

Angular leaf spot of cotton, bacterial leaf blight of rice, crown galls, bacterial cankers of citrus

Phytoplasmas Diseases

Aster yellow, citrus stubborn

Viral Diseases

Papaya ring spot, tomato yellow leaf curl, banana bunchy top, rice tungro

Viroid Diseases

Potato spindle tuber, coconut cadangcadang

Module V: - Control of Plant Diseases

Principles & practices involved in the management of plant diseases by different methods, viz. **regulatory** - quarantine, crop certification, avoidance of pathogen, use of pathogen free propagative material, **cultural** - host eradication, crop rotation, sanitation, polyethylene traps and mulches, **chemical** - protectants and systemic fungicides, antibiotics, resistance of pathogens to chemicals, **biological** - suppressive soils, antagonistic microbes-bacteria and fungi, trap plants, **genetic engineering** of disease resistant plants- with plant derived genes and pathogen derived genes

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books: -

1. Agrios GN. (2006). *Plant Pathology*. 5th edition. Academic press, San Diego,
2. Lucas JA. (1998). *Plant Pathology and Plant Pathogens*. 3rd edition. BlackwellScience, Oxford.
3. Mehrotra RS. (1994). *Plant Pathology*. Tata McGraw-Hill Limited.
4. Rangaswami G. (2005). *Diseases of Crop Plants in India*. 4th edition. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Singh RS. (1998). *Plant Diseases Management*. 7th edition. Oxford & IBH, New Delhi.

Microbial Ecology & Plant Pathology Lab.

Course Code: BSM 521

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 501 & BSM 503

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Microbial Genetics & Genomics Lab.

Course Code: BSM 522

Credit Units: 02

Course Objective: -

Aim of the course is to give hands on training to students for enhancing their practical skills of the subject domain.

Course Content

Minimum of 5-8 laboratory exercises will be conducted based on theory papers BSM 502

Examination Scheme:

Internal Assessment			External Evaluation	
Attendance	Performance	Lab Record	Performance	Viva
5	35	10	40	10

Industrial Safety & Management

Course Code: BSM 511

Credit Units: 03

Course Objective:-

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications.

Module I: - Hazards

Classification: Chemical hazards. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards. Biological 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. Waste management (Effluent treatment).

Module V: - Laws

Factory Act. ESI Act, Environmental Act. Workmen - compensation Act. Advantages of adopting safety laws.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Safety and Accident Prevention in Chemical Operation 2nd Edn., H.H. Fawcett & W.S. Wood Wiley Interscience(1982)
2. Industrial Safety Management by L M Deshmukh Publisher Tata McGraw-Hill Education(2005)

3. Industrial Safety and Health Management by C. Ray Asfahl , David W. Rieske, 6th Edition
Publisher: Prentice Hall(2009)

IPR and Bioethics

Course Code: BSM 512

Credit Units: 03

Course Objective:-

The aim of the course is to develop awareness among students for protecting intellectual property and ethics while planning research.

Module I:-

Introduction to human rights, International instruments: United Nation Commission for human rights, European convention for human rights, Universal Declaration of Human Rights (UDHR), National instruments: Development of human rights- Article 21 of Indian Constitution.

Module II:-

Human relations- ethnic and communal relations, socio-cultural relations etc. Economics of human rights and relations- Adam Smith's thoughts on moral sentiments, Economic philosophy of Thiruvalluvar. Gene cloning and bioethics.

Module III:-

Objectives of Intellectual Property Rights, tangible and intangible property; concept and classification of intellectual property: Copyrights and related rights, Trademarks and Geographical indications, Rights of traditional Knowledge and Protection of Plant varieties. IPR- National and International perspective, TRIPS and WIPO.

Module IV:-

Patent- Basic criterion for patentability, Patentable subjects, patentable inventions, patent acquisition, infringement of patent, discovery Vs invention, product patenting Vs process patenting, special issue in biotechnology patent, Patenting laws in Indian and International perspective,

Module V: -

Case studies: Basmati case, Neem controversy, Turmeric case.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Beauchamp, T. L., Walters, L., Kahn, J. P., Mastroianni, A. C. 2007. Contemporary Issues in Bioethics. 7th Edition. Wadsworth Publishing Company, California.
2. Paul, R.C. 2000. Situation of Human Rights in India. Commonwealth Publishers, New Delhi.
3. Daniel, Wayne W.: Biostatistics — A Foundations for Analysis in the Health Sciences. Wiley & Sons, New York, 6th ed. 1995,
4. Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers, Second edition (1 January 2007).
5. Fundamentals of Mathematical Statistics, Eleventh Edition (2014)S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co

GMP & Quality Control

Course Code: BSM 513

Credit Units: 03

Course Objective:-

- To train the students about the importance and requirement of good documentation practices.
- To impart training in good manufacturing practices and its conduct in manufacturing process.
- To understand the documentation procedures and their implementation.
- To introduce the basic concepts of GLP and its implementation.

Module I: -Definition - Quality control and Quality assurance, concept and philosophy of TQM, GMP, ICH and ISO 9000.

Module II: -GLP: Scope of GLP, Quality assurance unit, SOP, protocols for conduct of clinical & non clinical testing, control on animal house, report preparation and documentation.

Module III: -Quality control test for raw materials, packaging materials in food and pharmaceutical industry. Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, Quality audit reports and documents, quality reports, distribution records, complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Module IV: -In process quality control and finished products quality control in pharma and food industry, quality control of radio pharmaceuticals

Module V: - Regulatory affairs- international and national regulatory bodies for food and pharmaceuticals

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India, 3rd revised edition, Volume I & II, Mumbai, 1996.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69, Marcel Dekker Series, 1995.
3. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I& II, 2nd edition, WHO Publications, 1999.
4. How to Practice GMP's – P P Sharma, Vandana Publications, Agra, 1991.
5. The International Pharmacopoeia – vol I, II, III, IV & V - General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms, 3rd edition, WHO, Geneva, 2005.
6. Good laboratory Practice Regulations – Allen F. Hirsch, Volume 38, Marcel Dekker Series, 1989.
7. ICH guidelines
8. ISO 9000 and total quality management
9. The drugs and cosmetics act 1940 – Deshpande, Nilesh Gandhi, 4th edition, Susmit Publishers, 2006.
10. QA Manual – D.H. Shah, 1st edition, Business Horizons, 2000.
11. Good Manufacturing Practices for Pharmaceuticals a plan for total quality control – Sidney H. Willig, Vol. 52, 3rd edition, Marcel Dekker Series.

CLINICAL RESEARCH & PHARMACOVIGILANCE

Course Code: BSM 514

Credit Units: 03

UNIT-I

Basics of general Pharmacology & Drug discovery process

Drug, Receptors, Dosage forms, routes of drug administration, drug receptor interactions, drug drug interactions, drug resistance, drug tolerance, drug dependence, Pharmacokinetic (ADME) and Pharmacodynamic of drugs, Adverse drug effects.

General introduction about Drug discovery and development process, Bioavailability /Bioequivalence Studies and Pharmacovigilance.

UNIT-II

Basics of Clinical trials - Basics of clinical trials, Introduction and history of clinical trials, Types of clinical trials, Inclusion and exclusion criteria, Primary and Secondary outcome/endpoint of clinical trials, Needs of Clinical trials and Phases of clinical trials.

Various Key documents, application filling and Ethical regulation of Clinical trials:

- Investigator Brochure (IB), Protocol & Amendment in Protocol , Case Report Form (CRF),
- Informed Consent Form (ICF) , Essential Documents in Clinical Trial Good Clinical Practice: ICH guidelines, Indian GCP guidelines (CDCSO guidelines),
- Investigational new drug (IND) / clinical trial exception (CTX) / clinical trial authorization (CTA) application
- New drug application (NDA/ANDA) / marketing authorization application (MAA)
- ICMR Guideline - Ethical Guideline for Biomedical Research on Human Subjects & Schedule Y
- Ethical Codes – The Declaration of Helsinki.

UNIT-III

Clinical trial design: Need of clinical trial design

Treatment studies- Randomized controlled trial, Adaptive clinical trial, Nonrandomized trial, Observational studies- Cohort study, Case control study, Cross sectional study, Ecological study

UNIT-IV

Pharmacovigilance:

Introduction to adverse drug reactions: Definitions and classification of ADRs, Detection and reporting, Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment, Management of adverse drug reactions.

Introduction to pharmacovigilance: History and development of pharmacovigilance, Importance of safety monitoring / Why pharmacovigilance

National and international scenario: Pharmacovigilance in India, Pharmacovigilance global perspective, WHO international drug monitoring programme

Adverse drug reaction reporting: Introduction to reporting systems, Spontaneous reporting system, Reporting to regulatory authorities, Guidelines for reporting ADRs in biomedical literature

Drug dictionaries and coding in pharmacovigilance: WHO adverse reaction terminologies, MedDRA and Standardised MedDRA queries.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Reference Books

1. Methodology of Clinical Drug Trials, 2nd Edition. Spriet A., Dupin-Spriet T., Simon P. Publisher: Karger.
2. Design and Analysis of Clinical Trials: Concepts and Methodologies, 3rd Edition. SheinChung Chow, Jen-Pei Liu. Publisher: Wiley.
3. New Drug Development: Design, Methodology, and Analysis, by J. Rick Turner, Published by John Wiley & Sons, 2007.
4. Essentials of Medical Pharmacology by K D Tripathi, Published by JAYPEE Brothers Medical Publishers (P) Ltd. 7th Edition 2010.
5. Drug Discovery and Clinical Research, by S.K Gupta, Published by JAYPEE Brothers Medical Publishers (P) Ltd.
6. A Textbook of Pharmacovigilance: Concept and Practice, by Guru Prasad Mohanta, Published by PharmaMed Press/BSP Books (2015).

7. An Introduction to Pharmacovigilance, by Patrick Waller, Published by October 2009, Wiley-Blackwell.

COMMUNICATION SKILLS - III

Course Code: BCS 501

Credit Units: 01

Course Objective:

To equip the participant with linguistic skills required in the field of science and technology while guiding them to excel in their academic field.

Course Contents:

Module I

Reading Comprehension

Summarising

Paraphrasing

Module II

Essay Writing

Dialogue Report

Module III

Writing Emails

Brochure

Leaflets

Module IV: Introduction to Phonetics

Vowels

Consonants

Accent and Rhythm

Accent Neutralization

Spoken English and Listening Practice

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:

- Effective English for Engineering Students, B Cauveri, Macmillan India
- Creative English for Communication, Krishnaswamy N, Macmillan
- A Textbook of English Phonetics, Balasubramanian T, Macmillan

Behavioural Sciences-V

(Individual , Society and Nation)

Course Code: BSS 503

Credit Units: 01

Course Objective:

This course aims at enabling students towards:

Understand the importance of individual differences

Better understanding of self in relation to society and nation

Facilitation for a meaningful existence and adjustment in society

To inculcate patriotism and National pride.

To enhance personal and professional excellence

Course Contents:

Module I: Individual differences& Personality

Personality: Definition& Relevance

Importance of nature & nurture in Personality Development

Importance and Recognition of Individual differences in Personality

Accepting and Managing Individual differences (Adjustment Mechanisms)

Intuition, Judgment, Perception & Sensation (MBTI)

BIG5 Factors

Module II: Socialization

Nature of Socialization

Social Interaction

Interaction of Socialization Process

Contributions to Society & Nation

Module III: Patriotism and National Pride

Sense of Pride and Patriotism

Importance of Discipline and hard work

Integrity and accountability

Module IV: Human Rights, Values and Ethics

Meaning of Human Rights

Human Rights Awareness

Importance of human rights

Values and Ethics- Learning based on project work on Scriptures like Ramayana, Mahabharata, Gitaetc

Module V: Personal and Professional Excellence

Personal excellence:

Identifying Long-term choices and goals

Uncovering talent, strength and style

Alan P. Rossiter's eight aspects of Professional Excellence

Resilience during challenge and loss

Continued Reflection (Placements, Events, Seminars, Conferences, Projects, Extracurricular Activities, 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

Text & References:

- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- Robbins O.B.Stephen;. Organizational Behaviour

FRENCH - V

Course Code: FLT 501

Credit Units: 02

Course Objective:

To furnish some basic knowledge of French culture and civilization for understanding an authentic document and information relating to political and administrative life

Course Contents:

Module D: pp. 131 – 156 Unités 10,11

Contenu lexical : Unité 10: Prendre des décisions

1. Faire des comparaisons
2. décrire un lieu, le temps, les gens, l'ambiance
3. rédiger une carte postale

Unité 11: faire face aux problèmes

1. Exposer un problème.
2. parler de la santé, de la maladie
3. interdire/demander/donner une autorisation
4. connaître la vie politique française

Contenu grammatical:

1. comparatif - comparer des qualités/ quantités/actions
2. supposition : Si + présent, futur
3. adverbe - caractériser une action
4. pronom "Y"

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 - V

Course Code: FLG 501

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 Advanced Grammar and Business Language and Professional Jargon

Course Contents:

Module I: Genitive case

Genitive case – Explain the concept of possession in genitive

Mentioning the structure of weak nouns

Module II: Genitive prepositions

Discuss the genitive prepositions and their usage: (während, wegen, statt, trotz)

Module III: Reflexive verbs

Verbs with accusative case

Verbs with dative case

Difference in usage in the two cases

Module IV: Verbs with fixed prepositions

Verbs with accusative case

Verbs with dative case

Difference in the usage of the two cases

Module V: Texts

A poem 'Maxi'

A text Rocko

Module VI: Picture Description

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

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 - V

Course Code: FLS 501

Credit Units: 02

Course Objective:

To enable students acquire working knowledge of the language; to give them vocabulary, grammar, voice modulations/intonations to handle everyday Spanish situations with ease.

Course Contents:

Module I

Revision of earlier semester modules

Module II

Future Tense

Module III

Presentations in English on
Spanish speaking countries'

Culture

Sports

Food

People

Politics

Society

Geography

Module IV

Situations:

En el hospital

En la comisaria

En la estacionde autobus/tren

En el banco/cambio

Module V

General revision of Spanish language learnt 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:

- Español Sin Fronteras, Greenfield

CHINESE – V

Course Code: FLC 501

Credit Units: 02

Course Objective:

What English words come from Chinese? Some of the more common English words with Chinese roots are ginseng, silk, dim sum, fengshui, typhoon, yin and yang, T'ai chi, kung-fu. 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.

Pronunciation and intonation.

Character writing and stroke order

Module II

Intonation

Chinese foods and tastes – tofu, chowmian, noodle, Beijing duck, rice, sweet, sour...etc. Learning to say phrases like – Chinese food, Western food, delicious, hot and spicy, sour, salty, tasteless, tender, nutritious, good for health, fish, shrimps, vegetables, cholesterol is not high, pizza, milk, vitamins, to be able to cook, to be used to, cook well, once a week, once a month, once a year, twice a week.....

Repetition of the grammar and verbs taught in the previous module and making dialogues using it.

Compliment of degree “de”.

Module III

Grammar the complex sentence “suiran ... danshi....”

Comparison – It is colder today than it was yesterday.....etc.

The Expression “chule....yiwai”. (Besides)

Names of different animals.

Talking about Great Wall of China

Short stories

Module IV

Use of “huozhe” and “haishi”

Is he/she married?

Going for a film with a friend.

Having a meal at the restaurant and ordering a meal.

Module V

Shopping – Talking about a thing you have bought, how much money you spent on it? How many kinds were there? What did you think of others?

Talking about a day in your life using compliment of degree “de”. When you get up? When do you go for class? Do you sleep early or late? How is Chinese? Do you enjoy your life in the hostel?

Making up a dialogue by asking question on the year, month, day and the days of the week and answer them.

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-II Lesson 39-46



AMITY INSTITUTE OF MICROBIAL TECHNOLOGY (AIMT)

Program Name: B.Sc. (Hons.) MICROBIOLOGY

SIXTH SEMESTER

Course Code	Course Title	Category	Lectures(L) Hours per week	Tutorial (T) Hours per week	Practical (P) Hours per week	Total Credits
BSM 601	Bioanalytical Techniques & Statistics	CC	3	-	-	3
BSM 602	Food & Dairy Microbiology	CC	3	-	-	3
BSM 603	Marine Microbiology	CC	3	-	-	3
BSM 650	Educational/ Industrial Tour	NTCC	-	-	-	1
BSM 660	In House Project	CC	-	-	-	16
TOTAL						26

* One Industrial /Educational Tour can be organized in any Semester of Program and report evaluated will be in Semester VI

Total Credits (22+28+30+26+28+26) = 160

Bioanalytical Techniques & Statistics

Course Code: BSM 601

Credit Units: 03

Course Objective:-

The course gives introduction of analytical and statistical tools in the field of Biology

Module I: -

Principles and Applications of Autoclave, Hot air oven, Incubator, Laminar air flow chamber / Biosafety cabinets, BOD incubator, Incinerator.

Module II: -

Principles and Applications of Centrifugation– Low speed, High speed, Ultra centrifuge, lyophilizer., Spectrometry – Colorimetry, Turbidometry, UV & Visible Spectrophotometer, IR, NMR, Mass spectrometry-GCMS and LCMS. Flame Photometry.

Module III: -

Chromatography – Paper, Thinlayer, Column, Ion-exchange, permeation, affinity chromatography, Gas and HPLC. Electrophoresis – SDS – PAGE and Agarose gel electrophoresis, PFGE, Crystallography and X-Ray diffraction

Module IV: -

Nature and scope of statistical methods and their limitation. Compilation, classification, tabulation, and application in life science. Graphical representation, measure of average and dispersion mean, median, mode.

Module V: -

Sampling methods- simple random, stratified, systematic and cluster sampling procedures. Sampling distribution, Probability, Tests of significance based on T, Chi-square and F Test Designing and methodology of experiment

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Gedder, A. and L. E. Balser, John Wiley and Sons, Principles of applied Biomedical instrumentation.
2. Upadhyay & Upadhyay. Biophysical Chemistry. 2010 Edition. Himalaya Publishing House.
3. Dean, Willard and Merrit, Instrumental Methods of analysis Asian Ed.
4. Fritschen, L. J and L. W. Gay, Springer, Verlag, Environmental Instrumentation, 1979, New York.
5. Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry. 2nd Edition.
6. E.Padmini., Biochemical Calculations and Biostatistics (2007) Books and Allied (P) Ltd., First Edtn.
7. Fundamentals of Biostatistics. Bernard Rosner
8. Biostatistics for medical,nursing and pharmacy students.a.indrayan and L.Satyanarayana.
9. Statistics for Biologists.Campbell.R.C

Food and Dairy Microbiology

Course Code: BSM 602

Credit Units: 03

Course Objective:-

Course will make the students aware of application and roles of microbes on various aspects of food science.

Module I: - Microbial Food Spoilage

Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned foods

Module II: - Food preservation

Principles & Methods, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO₂, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins

Module III: - Fermented foods

Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh and probiotics, fermented meat products.

Module IV Food borne diseases

Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and mycotoxins;
Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, Salmonellosis, Shigellosis, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*

Module V: - Food sanitation and control

Treatment and safety of drinking (potable) water, methods to detect potability of water samples:

(a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests

HACCP, Indices of food sanitary quality and sanitizers

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books:-

1. Adams MR and Moss MO. (1995). *Food Microbiology*. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). *Basic Food Microbiology*. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Davidson PM and Brannen AL. (1993). *Antimicrobials in Foods*. Marcel Dekker, New York.
4. Dillion VM and Board RG. (1996). *Natural Antimicrobial Systems and Food Preservation*. CAB International, Wallingford, Oxon.
5. Frazier WC and Westhoff DC. (1992). *Food Microbiology*. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Gould GW. (1995). *New Methods of Food Preservation*. Blackie Academic and Professional, London.
7. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7th edition, CBS Publishers and Distributors, Delhi, India.
8. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
9. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. 9th edition. Pearson Education.

Marine Microbiology

Course Code: BSM 603

Credit Units: 03

Course Objective:-

The aim of this course is to aware students about world's oceans & seas and its micro flora. It will also explain role of microbes in ocean processes.

Module I: - Marine Environment

World's oceans & Seas, Physico – Chemical properties of marine water, marine microbial habitat: water column, sediments, costal ecosystems, mangroves salt marshes. Bio-films& Microbial mats. Microbial life at surface of living & non living systems and microbial interactions.

Module II: - Methods in Marine Microbiology

Sampling methods of different habitat of oceans and screening by CLSM & FCM. Importance of Culturable & non Culturable microorganisms. Molecular tools to study marine diversity.

Module III: - Role of Microbes in ocean processes

Bio-Energetics, Carbon & Nitrogen cycling in ocean, Photosynthesis and Primary productivity. Eutrophication of coastal areas. Microbial loop in ocean food web. Microbial processes and climate change. Bio – fouling & bio – deterioration, indicator organisms and pollution control. Symbiosis of microalgae with animals : Chemoautotrophic prokaryotes with animals. Symbionts of sponges, mixotrophy in protists. Metabolic consortia and mutualism between prokaryotes.

Module V: - Recent trends in Marine Microbiology

Biodegradation and Bioremediation of marine pollutants (oil, Organic comp. etc.). Recently identified microorganisms of marine ecosystem, there applications in present and future industries.

Examination Scheme:

Components	C T	Assignment	Project	Case Study	Attendance	EE
Weightage (%)	15	10	10	10	5	50

Text and Reference Books

1. Munn, C. 2011. Marine Microbiology: Ecology and Applications. GS Publications. PP- 648
2. Sekwon Kim. 2013. Marine Microbiology: Bioactive compounds and Biotechnological applications. Wiley VCH.
3. Paul, J. 2001. Marine Microbiology. Academic Press. PP-666.

Educational/ Industrial Tour

Course Code: BSM 650

Credit Units: 01

In House Project

Course Code: BSM 660

Credit Units: 16