

Swami Ramanand Teerth Marathwada University, Nanded

Syllabus B.Sc. Biotechnology (Revised)

(w.e.f. June - 2013)

B. Sc. Biotechnology First Year (First Semester)

Code No.	Paper Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT-1.1	Introduction to Biotechnology	04	80	20	100	03
BTT-1.2	Basics of Biosciences	04	80	20	100	03
BTT-1.3	Biomolecules	04	80	20	100	03
BTT-1.4	Fundamentals of Chemistry	04	80	20	100	03
BTP-1.1	Lab Course-1 (Practical based on BTT-1.1 +BTT-1.2)	03+03	100	-	100	03
BTP-1.2	Lab Course-2 (Practical based on BTT-1.3 +BTT-1.4)	03+03	100	-	100	03
				Total	600	

B. Sc. Biotechnology First Year (Second Semester)

Code No.	Paper Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT-2.1	English & Communication Skills	04	80	20	100	03
BTT-2.2	Microbiology	04	80	20	100	03
BTT-2.3	Principles of Genetics	04	80	20	100	03
BTT-2.4	Bioinstrumentation Techniques	04	80	20	100	03
BTP-2.1	Lab Course -3 (Practical based on BTT-2.1+ BTT-2.2)	03+03	100	-	100	03
BTP-2.2	Lab Course -4 (Practical based on BTT-2.3+ BTT-2.4)	03+03	100	-	100	03
				Total	600	

B. Sc. Biotechnology Second Year (Third Semester)

Code No.	Paper Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT-3.1	Metabolism-I	04	80	20	100	03
BTT-3.2	Cytology	04	80	20	100	03
BTT-3.3	Molecular Biology	04	80	20	100	03
BTT-3.4	Mathematics, Biostatistics and Computers	04	80	20	100	03
BTP-3.1	Lab Course -5 Practical Based on (BTT-3.1 + BTT-3.2)	03+03	100	-	100	03
BTP-3.2	Lab Course -6 Practical Based on (BTT-3.3+ BTT-3.4)	03+03	100	-	100	03
				Total	600	

B. Sc. Biotechnology Second Year (Fourth Semester)

Code No.	Paper Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT-4.1	Metabolism-II	04	80	20	100	03
BTT-4.2	Applied & Medical Microbiology	04	80	20	100	03
BTT-4.3	Immunology and Virology	04	80	20	100	03
BTT-4.4	Plant and Animal Cell Culture	04	80	20	100	03
BTP-4.1	Lab Course -7 Practical Based on (BTT-4.1 & BTT-4.2)	03+03	100	-	100	03
BTP-4.2	Lab Course -8 Practical Based on (BTT-4.3 & BTT-4.4)	03+03	100	-	100	03
				Total	600	

B. Sc. Biotechnology Third Year (Fifth Semester)

Code No.	Paper Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT-5.1	r- DNA Technology	04	80	20	100	03
BTT-5.2	Agriculture Biotechnology	04	80	20	100	03
BTT-5.3	Bioprocess Engineering	04	80	20	100	03
BTT-5.4	Animal and Plant Development	04	80	20	100	03
BTP-5.1	Lab Course -9 Practical Based on (BTT-5.1 + BTT-5.2)	03+03	100	-	100	03
BTP-5.2	Lab Course -10 Practical Based on (BTT-5.3 + BTT-5.4)	03+03	100	-	100	03
				Total	600	

B. Sc. Biotechnology Third Year (Sixth Semester)

Code No.	Paper Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT-6.1	Pharmaceutical Biotechnology	04	80	20	100	03
BTT-6.2	Industrial Biotechnology	04	80	20	100	03
BTT-6.3	Environment Biotechnology	04	80	20	100	03
BTT-6.4	Introduction to Bioinformatics	04	80	20	100	03
BTP-6.1	Lab Course -11 (Practical based on BTT-6.1+6.2+6.3+6.4)	03+03	100	-	100	03
BTP-6.2	Lab Course -12 (Project Work)	03+03	100	-	100	03
				Total	600	

B.Sc. Biotechnology I Semester**BTT-1.1: Introduction to Biotechnology****Marks: 80****Hours: 50****Objective:** To have overview and broader understanding of world of Biotechnology**Unit-I: Introduction:** Definition, Historical overview of Biotechnology, Recent discoveries from Cell biology to Biotechnology. Introduction to Bioinformatics, Nanobiotechnology.**Biotechnology in Agriculture:** Plant tissue culture, Seed Technology, Plant Breeding, Transgenic plants with examples. Biofertilizers, Biopesticide, etc.**Unit II: Biotechnology in Health & Biopharmaceuticals: Diagnostics-** Ag-Ab Interactions and other types of diagnosis. **Therapeutics-** Antibiotics, Synthetic and therapeutic peptides/macromolecules, hormones, vitamins and health supplements. **Vaccines-** recombinant, edible vaccines. Concept of Stem Cells, Hybridoma Technology, Genetic Counseling. Transgenic Animals and their applications.**Unit-II: Biotechnology in Industry:** Beverage-Winery, Distillery, Solvents. Dairy, Bakery, Food Processing and packaging, Enzymes, Acids, Cosmetics, Paper & Pulp etc**Unit-IV: Biotechnology in Environment & Biodiversity:** Waste Water Treatment, Biodegradation, Bioremediation, composting, Solid waste Management. Biofuel- Biodiesel, Biogas, Ethanol. Biodiversity: *in situ*, *ex situ* conservation of endangered species. Ethical, Legal (IPR, Patent) and Social impact of Biotechnology.**Reference Books & Text:**

1. Introduction to Biotechnology- Brown, Campbell, Priest-Panima Publications
2. Biotechnology-U Satyanarayana- New Age
3. Biotechnology - B.D. Singh, Kalyani Publications
4. Biotechnology: Expanding Horizons- B.D. Singh- Kalyani Publications
5. Elements of Biotechnology - P.K. Gupta, Rastogi Publications
6. A Text book of Biotechnology - R.C. Dubey- S. Chand
7. Advances in Biotechnology- S.N. Jogdand- Himalaya Publication
8. Concepts in Biotechnology-Balasubramanian- University Press
9. Biotechnology - Purohit- Agrobios Publication
10. Modern concepts of Biotechnology, H.D. Kumar, Vikas Publications

Practicals

Students are expected to go on field study to reveal the applied areas of biotechnology, Biotech Companies, Products and their impact on society.

1. Survey and report on commercial dairy products and packaged food products available in market
2. Survey and report on bio fertilizers, plant growth stimulators and supplements available in market
3. Survey and report on bio pesticides, and bio control agents available in market
4. Survey and report on genetically modified/hybrid crops seeds and vegetables
5. Survey and report on vaccination programme in India and vaccines in market
6. Survey and report diagnostic kits, antibiotics, anti sera available in market
11. Survey and report on use of Biofuel (Biodiesel, biogas, ethanol, biomass, coal etc)
12. Visit and report on local drinking and waste water treatment, bio composting, biogas unit
13. Report on government agencies- DBT, CSIR, ICMR, ICAR, TIFR, ISSER, IIT, DRDO etc
14. Report on Top 20 Biotech companies in India and World
15. Visit and report on Biotech Research Institute, Forensic Laboratory and Biotech Industry

B.Sc. Biotechnology I Semester**BTT 1.2: Basics of Biosciences****Marks: 80****Hours: 50****Objective:** To understand the basic concept of Life forms, Evolution and Biodiversity**Unit-I: Evolution in life**

Prebiological chemical evolution, Diversity of living world, Whittaker's Five Kingdom System, Classification up to genus & species level, Brief account of Prokaryotic & eukaryotic cell.

Unit-II: Plant body organization

a) **Structural** Morphology of vegetative and reproductive organs of monocot & dicot plants
 b) **Anatomy** – Internal organization of vegetative and reproductive organs of monocot & dicot plants
 c) **Functional - Flower-** Parts and their functions. **Inflorescence-** Types, special types of inflorescence, **Physiology of flowering** –Photoperiodism, Vernalization and Dormancy **Fruit-** Types of fruit , Parthenocarpy. **Seed** – Development, structure, germination, control of seed germination, Development of special perennating organs – bulb, tuber, corm, rhizome.

Unit-III : Brief Introduction to types of Animals

Placentation in mammals, Gamatogenesis, reproductive cycles, fertilization, gestation, Partuition & lactation and Introduction to Immuno Contraception, Nuclear & Embryo transplantation.
 A Brief Introduction to Apiculture, Sericulture, Aquaculture & Vermiculture.

Unit-IV: Fungi

General characters of Fungi, Ultra structure of typical fungal cell, cell wall composition, Nutrition, Reproduction, Types of spores, effect of environment on growth, prevention of fungal growth.

Reference Books:

1. Botany by –A.C. Dutta- Oxford
2. Botany for Degree Students- Vasitha- S. Chand Publication
3. College Botany- B.P. Pandey- S.Chand
4. An Introduction to Mycology- K.R.Aneja- New Age
5. Plant Physiology-Sundara Ranjan- Anmol Publication
6. Fundamentals of Plant Physiology- V.K. Jain- S. Chand
7. Fungi for Degree Students- Vashist- S.Chand
8. Zoology –Jordan & Verma-S. Chand
9. Chordate Embryology- Verma, Agarwal- S.Chand
10. Plant physiology, Biochemistry & Biotechnology- Verma & Verma- S Chand

Practicals:

1. Study of T S of Monocot & Dicot stem and root
2. Study of Flower, Inflorescence, fruits, Seeds
3. Study of TS of anther and ovule
4. Preparation of Potato dextrose agar and growth of any fungus
5. Study of embryo development (Chicken /Frog)
6. Study of extra embryonic membranes in chicks
7. Visit to a protected area of the state to understand and appreciate biodiversity
8. Observation of permanent slides of anther, ovule, embryo sac, embryo and endosperm etc
9. Study of eukaryotic and prokaryotic cell structures.
10. Field visit & report.

B.Sc. Biotechnology I Semester**Code: BTT-1.3****Biomolecules****80 Marks****50 Hours****Objective:** To focus on the basic concept of Biomolecules & their physiological role in life.**UNIT-I:****Carbohydrate:** Nomenclature, Classification (Monosaccharides, oligosaccharides, polysaccharide), structure & functions, chemical properties and structural aspects of Monosaccharides (Glucose), Disaccharides (Sucrose, Lactose) and polysaccharides (Starch, Glycogen, Cellulose).**UNIT-II:****Amino Acid:** Classification and Structure, Physical and Chemical properties.

Peptides- Nomenclature, Classification and examples.

Proteins- Classification (on the basis of solubility, molecular weight, shape, composition) Properties and Structure (Primary, Secondary, Tertiary and Quaternary) with examples. Role in biological system.**Enzyme-** Nomenclature and Classification. Role of enzymes.**UNIT-III:****Nucleic Acid:** Structure of nucleus acid – Nitrogenous bases, pentose, nucleotides, nucleosides, nucleoside di and triphosphate. Basic structure of DNA & RNA, Forms of DNA, Types of RNA, physico-chemical properties and biological function of nucleic acids.**UNIT-IV:****Lipid-** Classification (Saturated and Unsaturated fatty acid) structure and Biological role, Cholesterol.**Vitamin-** Structure, Physiological role. Deficiency disorder of water soluble and fat soluble.**Text & References:**

1. Biochemistry- U. Satyanarayana & Chakrapani- New Age
2. General Biochemistry- J.H. Weil- New Age
3. Fundamentals of Biochemistry- A.C. Deb- Central publication
4. Lehninger Biochemistry- Kalyani Publication
5. Principle of Biochemistry- Cohn and Stumpf.
6. Biochemistry- Powar & Chatawal- Himalaya
7. Biochemistry- J.L Jain- S.Chand
8. Biochemistry- Rastogi- Tata Mcgraw Hill
9. General Microbiology- Powar & Dagainawala- Himalaya

Practicals:

1. General and Safety Rules of Laboratory
2. Preparation of Standard solutions – Molar, Molal, Normal, Percent.
3. Identification of Bio molecules by Spot test.
4. Study of Lambert Beer's Law
5. Estimation of Carbohydrate by DNS Reagent.
6. Estimation of Protein by Biuret method.
7. Qualitative estimation of DNA by Diphenylamine method.
8. Determination of acid value of oil and fat.
9. Estimation of vitamin by DNPH/ Iodometric method.
10. Preparation of Buffers Solutions
11. Study of Enzymes.

B.Sc. Biotechnology I Semester**BTT -1.4: Fundamentals of Chemistry****Marks: 80****Hours: 50****Objective:** To focus on the basic concepts of Chemistry, atomic and molecular nature and interactions**Unit-I: Atomic Structure and Periodicity**

Quantum Chemistry, Bohr's Atomic Model, Rutherford's Atomic Model, Planks quantum theory, Quantum Mechanical Model of Hydrogen atom, Electronic Configuration of atoms, Periodic Trends, Ionization energy, Electro negativity, Atomic Size.

Unit-II: Structure and Bonding

Types of Chemical Bond: Ionic, Covalent & coordinate bonding, VSEPR theory, shape of molecule, hybridization, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding van-der Waals interactions, Ionic Solids, Ionic radii, lattice energy (Born-Haber cycle)

Unit-III: Chemical Equilibrium

Colligative properties of solutions, Concept and Theories of Acid and Base. Ionic equilibrium in solution, solubility product, Common Ion Effect, hydrolysis of salts, pH, buffer and their application in chemical analysis.

Unit-IV: Reaction Kinetics & Thermodynamics

Rate Constant, Order of Reaction, Molecularity, Activation energy, Zero, First and Second order kinetics, catalysis, types of catalysis and elementary enzyme reactions.

Thermodynamics: First law, reversible and irreversible processes, internal energy, enthalpy, Kirchoff's equation. Heat of reaction Hess law, Heat of formation, Second law, entropy, free energy and work function. Gibbs-Helmholtz equation. Clausius Clapeyron equation, free energy change and equilibrium constant. Mechanistic Basis of organic reactions: Elementary treatments of SN1, SN2, E1 and E2 reactions. Structure reactivity co-relations: Acid and bases, Steric effect, optical and geometrical isomerism, Tautomerism.

Reference Books:

1. Text book of Physical Chemistry- Puri Sharma- S. Chand
2. Text book of Physical Chemistry- Bhal & Tuli- S.Chand
3. Text book of Physical chemistry- K.L. Kapoor
4. Text book of Inorganic Chemistry- Puri Sharma & Kalia-
5. Advance Inorganic Chemistry-Gurdeep Raj- Goel
6. Concise Inorganic Chemistry- Lee-Blackwell Science
7. Text book of organic chemistry- Morrison and Boyd
8. Advance Organic Chemistry- Bhal & Bhal- S. Chand
9. Organic Chemistry- Ghosh- New Central Book
10. Understanding Chemistry-CNR RAO-University Press

Practical

1. Rules and safety measures in Chemistry Laboratory,
2. Study and care of glassware, handling of instruments planning and recording of experiment
3. Introduction to measurements, balance, burette, pipette, Standard flasks etc
4. Study of principle and working of pH meter and Standard Buffers.
5. Study and preparation of Distilled water.
6. Determination of Normality and Strength of given Solution by volumetric analysis
7. Problems based on pH determination of buffers.
8. Study of buffering capacity of buffer solutions.
9. Distillation of ethanol water mixture using water condenser.
10. Study of kinetics of cooling of hot water

B.Sc. Biotechnology II Semester

BTT 2.1: English & Communication Skills

Marks: 80

Hours: 50

Objective: To improve the skills in correct English in writing and pronunciation

Unit I: Grammar

Word Classes (Open & Closed), Sentence – Kinds – Transformation, Phrase, Clause and its kinds, Simple, Complex & Compound sentences, (Only definitions & Structure)

Tenses - Use of verbs in the Sentences

Unit II: Vocabulary

Morphology, Synonyms & Antonyms, One Word Substitution, Homophones & Homonyms

Unit III Communication Skills

Definition & its all Types, Communication Cycle & Barriers, Principles for Effective Communication, Varieties in English (Indian, British & American).

Unit IV: Writing Skills

Letters (Formal & Informal), Report Writing (Scientific and Formal), Memorandum, Curriculum Vitae, Personal Employment Interview, Group Discussion.

Phonetics: 44 sounds, consonants, vowels & Diphthongs, Transcription of words, Accent, Syllable cluster and Intonation.

Reference Books:

1. Developing of Communication Skills -Krishna Mohan & Meera Banerji
2. A Practical English Grammar A.J. Thomson -Oxford
3. Mastering English Grammar – S.H.Burton
4. Technical Communication- Raman Sharma- Oxford
5. Written Communication in English – Sarah Freeman Orient Longman Pvt. Ltd.
6. A Course in Phonetics & Spoken English -J.Sethi & P.V.Dhamija
7. Radiance-Tengse

Practicals

1. Seminar
2. Extempore
3. Mock Interviews & GD
4. Newspaper Advertisements
5. Quiz\ MCQ test practice in the syllabus subjects
6. Translations : Mother Tongue to English
7. SWOT Analysis, Motivation and Time Management

B.Sc. Biotechnology II Semester**BTT-2.2 Microbiology****80 Marks****50 Hours****Objective:** To understand basic concepts in Microbiology**Unit –I: Introduction to Microbiology**

History of Microbiology: Discovery of microscope and Microbial world: Micrographia of Anton von Leeuwenhoek and Robert Hooke. Controversy over Abiogenesis: Aristotle's notion about spontaneous generation, Redi's experiment, Louis Pasteur's & Tyndall's experiment. Theory of fermentation, Discovery of anaerobic life & physiological significance of fermentation. Surgical antisepsis, Germ theory of disease – Koch's postulates & River's postulates.

Basic and applied areas: Medical Microbiology, Space microbiology, Soil and Agricultural Microbiology, Food and Dairy Microbiology, Geomicrobiology. Concept of Systematic and Classical taxonomy including Bergey's Manual of Bacteriology.

Unit-II: Morphology and Fine Structure of Bacteria

Morphology of Bacteria, Size and shape, Arrangements.

Ultra structure of Bacteria Structure, function and chemical composition of Capsule, Flagella, Pili and Fimbriae, Cell Wall (Gram positive & Gram negative), Cell membrane, Mesosome, Cytoplasm, Nucleoid and ribosome's. Cytoplasmic inclusion – PHB granules, glycogen, carbohydrates, Magnetosome, Gas vesicles, chlorosome, sulphur, granules. **Spore and Cyst-**Endospore and Exospores, Germination and Sporulation of endospore.

UNIT-III: Microbial Nutrition, cultivation, and growth

Nutritional requirements – Major and Minor elements and growth factors. Nutritional types of microorganisms. Nutrient uptake mechanisms: Active and passive Diffusion, Osmosis. Types of Culture media with examples (Defined, Selective, natural, Differential, enrichment, Synthetic). Pure culture techniques (Streak, pour, Spread plate and roll tube method)

Bacterial Growth: Growth Kinetics and growth curve; Generation time, Growth rate, specific growth rate. Methods of Enumeration -Microscopic methods, Plate counts, Biomass, Chemical methods, Optical density. Continuous culture – Chemo stat and Turbido stat models, Diauxic growth and Synchronous culture.

Unit-IV: Control of Microorganisms.

Concept of Pasteurization, Tyndallization, Sterilization. Physical methods of Microbial Control: Heat: Moist & Dry, Low temperature, Filtration, High pressure, Desiccation, Osmotic pressure Radiations. Chemical methods of Microbial Control: Phenolics, Biguanides- Chlorohexidine, Alcohols, Halogens, Heavy Metals, Quaternary ammonium compounds, Surface active agents, Aldehydes, Sterilizing gases, Peroxygens, chemotherapeutic agents.

Text & References:

1. General Microbiology-Powar and Daginawala- Himalya Publication
2. Fundamental Principles of Bacteriology- A.J.Salle- TATA-McGraw Hill
3. General Microbiology-Pelczar- Tata McGraw Hill
4. Text-book of Microbiology- Anantnarayan, C.K. Jayram, Panikar, Orient Longman.
5. General Microbiology- Stanier R.-. Macmillan Press Ltd.
6. Text Book of Microbiology- R.C. Dubey- S.Chand

Practicals:

1. General Rules and Safety in Microbiology Laboratory.
2. Preparation of solid and liquid media (Slant, butts & Plates)
3. Isolation of bacteria by spread plate, streak plate and pours plate method, Colony Characters
4. Staining techniques: Simple staining, Negative staining and Gram staining.
5. Study of motility of Microorganisms by hanging drop, Cragie tube method.
6. Measurement of size of microorganism by Micrometry method
7. Study of bacterial growth curve by different methods.

B.Sc. Biotechnology II Semester

Code: BTT 2.3 Principles of Genetics 80 Marks 50 Hours

Objective: To focus on the principles of classical, modern & population genetics and principle of inheritance.

UNIT-I: Mendelian laws of Inheritance, & interaction of genes for monohybrid & dihybrid (incomplete dominance, co dominance, complementary & supplementary gene action, duplicate gene action, collaborator gene action, epistasis), Lethality & its types, Multiple alleles & isoalleles, scope & significance of genetics. Linkage & crossing over, its types, Mapping of genes, interference; coincidence.

UNIT-II: Sex determination in plants & animals. Sex Linkage, sex influenced & sex limited inheritance. Basic Microbial genetics: Conjugation, Transformation transduction & their use in genetic mapping. Plasmid & its types. Transposable elements.

UNIT-III: Concept of Gene. Classical & modern gene concepts; Structure of Eukaryotic chromosome, Special types of chromosomes: Polytene & Lampbrush chromosome. Mutations-spontaneous & induced; chemical & Physical mutagens; induced mutation in plants, animals & microbes for economic benefit of man.

UNIT-IV: Structural & numerical aberrations involving chromosomes; evolution of wheat, cotton & rice; hereditary defects-Klinefelter Turner, Cri-du-Chat & Down syndromes. Extra chromosomal inheritance: Cytoplasm inheritance; mitochondrial & chloroplast genetic systems. Population genetics Hardy-Weinberg equilibrium, gene & genotypic frequencies.

Text & References:

1. Concepts of genetics (Sixth Edition), William S. Klug & Michael R, Cummings, Person
2. Genetics, M.W., Strickberger, Prentice Hall College Division.
3. Genetics, P.J. Russel, Benjamin/Cummings.
4. Principles of Genetics, E.J. Gardner, John W.H. Sons Inc.
5. Genetics - Verma Agarwal- S. Chand
6. Genetics –B.D. Singh –Himalaya Publication
7. Microbial Genetics- David Friefelder- Narosa Publications
8. Molecular Biology of Gene -J.D. Watson -Pearson.
9. Genetics, P.K. Gupta- Rastogi Publication.
10. General Microbiology- Powar & Daginawala- Himalaya
11. Genetics-Arora-Himalaya Publications

Practicals:

1. Two examples each on Dihybrid & Monohybrid cross.
2. One example each on interaction of genes.
3. Two examples on Hardy Weinberg law.
4. Study of Karyotype.
5. Study of Human blood group.
6. Observe sex linked characters in tabulation from surroundings.
7. Study of Human Traits
8. Study of polytene chromosome.

B.Sc. Biotechnology II Semester**Code: BTT.2.4****Bioinstrumentation Techniques****80 Marks****50 Hours**

Objective: Objective of the course is to focus on basic principles of different instruments & their application in Biotechnology.

UNIT-I: MICROSCOPY & SPECTROSCOPY:

Light Microscopy: Simple & Compound Microscope, Phase contract Microscope, Electron Microscope (TEM/CEM) (Principle, Theory, ray diagram, Image formation and applications).

Spectroscopy: General principle, Electromagnetic Spectrum, radiation energy & atomic structure, Types of Spectra & their biochemical usefulness. Basic law of absorpction, Visible & Ultraviolet Spectroscopy, application in biology.

UNIT-II: CHROMATOGRAPHY

Adsorption chromatography, Partition chromatography: Paper Chromatography, TLC, Column Chromatography, Ion exchange chromatography, GC.

UNIT-III: CENTRIFUGATION

Centripetal Force, Centrifugal force, basic principle of centrifugation, centrifuge type, types of rotor density gradient centrifugation, Nature of density gradient, preparative centrifugation, Differentials centrifugation & applications.

UNIT-IV: ELECTROPHORETIC TECHNIQUES

General Principles, Law & High voltage electrophoresis, Agarose, PAGE & SDS PAGE. Isoelectric focusing (IEF), Pulse field gel electrophoresis. Factors affecting on Electrophoretic Mobility.

Text & References:

1. Biophysical Chemistry- Upadhyay, Upadhyay and Nath-Himalaya
2. Practical Biochemistry- Wilson & Walker -Cambridge
3. Practical Biochemistry- David Plummer- Tata McGraw Hill
4. Principles of Biochemistry- Lehninger –Kalyani Publications
5. Light Microscopy in Biology-A.J. Laccy.
6. Instrumental Methods of Chemical Analysis- Chatwal Anand- Himalaya
7. Instrumental Methods of Chemical Analysis –B.K. Sharma-Goel
8. Physical Biochemistry-D. Friefilder

Practicals:

1. Study and Care of Microscope, Observation of Microscopic samples
2. Study of Colorimeter and determination of Lambda Max.
3. Study of UV-Visible Spectrophotometer
4. Study of Paper Chromatography/ TLC.
5. Separation of Pigments/ Biomolecules by Chromatography.
6. Separation of pigments by column chromatography
7. Demonstraion of GC/ HPLC/ HPTLC
8. Principals and working of different centrifuges.
9. UV Spectroscopic Analysis of DNA, RNA & Proteins
10. Study of Paper/PAGE/ SDS-PAGE/ Agarose Gel Electrophoresis