

CURRICULUM

III SEMESTER

S. No.	Subject Name	L	P	M
Theory				
1.	Biochemistry	4	0	100
2.	Cell Biology	4	0	100
3.	Microbiology	4	0	100
4.	Genetics	4	0	100
5.	Introduction to Biotechnology	4	0	100
6.	Unit Operations	4	0	100
Practicals				
1.	Biochemistry	0	3	100
2.	Microbiology	0	3	100

BIOCHEMISTRY

AIM

To understand the basic concepts of Biochemistry. This will be a prerequisite for the courses offered in the subsequent semesters.

OBJECTIVES

At the end of the course, the students would have learnt about

- Carbohydrates and Lipids
- Proteins and Nucleic acids
- Metabolic Pathways
- Bioenergetics
- Vitamins.

UNIT I

BIOMOLECULES (INTRODUCTION, CARBOHYDRATES AND LIPIDS)

Types of biomolecules, Chemical nature and biological role, Classification, Structure and properties – Carbohydrates (Monosaccharides, Disaccharides, Oligosaccharides and polysaccharides), Lipids (Fatty acid, Glycerolipids, Phospholipids, Glycolipids, Sphingolipids, Steroids).

UNIT II

PROTEINS AND NUCLEIC ACIDS

Classification, Structures and properties – Proteins (Amino acids, Polypeptides, Conjugated proteins, Glycoproteins and Lipoproteins), Nucleic acids (Purines, Pyrimidines, Nucleosides, Nucleotides, Ribonucleic acids, Deoxyribonucleic acids and Nucleoproteins)

UNIT III

METABOLISM

Biocatalysis by enzymes and their pathways, Biosynthesis and breakdown of carbohydrates, Lipids, Proteins and Nucleic acids. Intermediary metabolism – TCA cycle, Glycolysis, Gluconeogenesis, Pentose Phosphate Shunt, Embden Meyerhof Pathway, Urea Cycle.

UNIT IV

BIOENERGETICS

High – Energy and electronegative potential of compounds, Respiratory chain, TP cycle, Calculation of ATP production during Glycolysis and TCA and regulation for high energy compounds and reducing equivalents inside the cell.

UNIT V

VITAMINS

Fat soluble vitamins – Classification, Occurrence, Properties, Structure and Functions of vitamin A, D, E and K. Water soluble vitamins – Classification, Occurrence, Properties, Structure and Functions of Thiamine, Riboflavin, Pyridoxine, Niacin, Biotin, Folic acid, B₁₂, Ascorbic acid, Classification, Structure and functions of Coenzymes.

TEXT BOOKS

1. Ambika Shanmugham. Text Book of Biochemistry for Medical Students.
2. Sathyanarayana, U. and Chakrapani, U., 2006. Biochemistry. 3rd Edn., Uppala Author Publishers Interlinks.
3. Jain, J.L., Sunjay Jain and Nitin Jain. Fundamentals of Biochemistry.
4. Rastogi, S.C. Biochemistry.
5. Chatterjea, M.N. and Rana Shinde, 2000. Text Book of Medical Biochemistry. 4th Edn., Jaypee Brothers Medical Publishers Pvt. Ltd.
6. Narayanan, L.M., Nallasingam, K., Arumugam, N., Dulsy Fathima, Meyyan Pillai, R.P. and Prasanna Kumar, S. Biochemistry.
7. Powar - Chatwal. Biochemistry.

REFERENCES

1. David L. Nelson and Michael M. Cox, 1982. Lehninger Principles of Biochemistry. 4th Edn., W. H. Freeman and Company.
2. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, 2001. Biochemistry. 5th Edn., W. H. Freeman and Company.
3. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell, V.W. and Harper, 2006. Biochemistry. 27th Edn., Mc Graw Hill Education Publishers.
4. Donald Voet and Judith Voet, G., 2004. Biochemistry. 3rd Edn., Wiley International Publishers.

CELL BIOLOGY

AIM

The course aims to develop skills of the students in the area of Cell biology and Cell Signalling pathways. This will be a prerequisite for courses like Molecular biology.

OBJECTIVES

At the end of the course, the students would have gained extensive knowledge on

- Functions of the organelles
- Cell membrane and permeability
- Cell Signalling molecules
- Signal transduction
- Cell culture.

UNIT I

CELL AND FUNCTIONS OF THE ORGANELLES

General structure – Prokaryotic and eukaryotic cell, Molecular organization of the cell membrane, Cell membrane – Proteins, Lipids and carbohydrates, Cytoskeletal proteins, Types of cell functions, Cell division, Mitosis and meiosis, Cell cycle.

UNIT II

CELL MEMBRANE AND PERMEABILITY

Passive and active transport, Permeases, Sodium potassium pump, Ca^{2+} , ATPase pumps, Lysosomal and vacuolar membrane, ATP dependent proton pumps, Co transport – Symport, Antiport, Transport into prokaryotic cells, Endocytosis and exocytosis, Entry of viruses and toxins into cells.

UNIT III

CELL SIGNALLING MOLECULES AND THEIR RECEPTORS

Cytosolic, Nuclear and membrane bound receptors, Examples of receptors, Modes of cell-cell Signalling – Autocrine, Paracrine and endocrine models of action, Quantitation and characterization of receptors.

UNIT IV

PATHWAYS AND INTRACELLULAR SIGNAL TRANSDUCTION

Signal amplification – Different models of signal amplifications, Cyclic AMP, Role of inositol phosphate as messengers, Biosynthesis of inositol triphosphates, Cyclic GMP and G proteins role in signal transduction, Calcium ion flux and its role in cell Signalling, Current models of signal amplification, Phosphorylation of protein kinases.

UNIT V

CELL CULTURE

Techniques for the propagation of prokaryotic and eukaryotic cells, Cell line, Generation of cell lines, Maintenance of stock cells, Characterization of cell, Morphological analysis techniques in Cell culture, Explant cultures, Primary cultures, Contamination, Differentiation.

TEXT BOOKS

1. De Robertis and De Robertis. Cell Biology. 8th Edn., *B.I. Publications Pvt. Ltd.*
2. James D. Watson. Molecular Biology of the Cell.
3. Verma, P.S. and Agarwal, V.K. Cell and Molecular Biology.

REFERENCES

1. Darnell J. Lodish, Baltimore, H. and Freeman, D., 1990. Molecular Cell Biology. *W. H. Freeman and Company.*
2. Kimball, T.W., 1989. Cell Biology. *Wesley Publishers.*
3. Geoffrey M. Cooper. The Cell. *ASM Press, Washington.*

MICROBIOLOGY

AIM

To know the fundamentals of Microbiology by studying the Characteristic structural organization and replication of micro organisms, Microscopy, Microbial nutrition and metabolism, Effects of Microbes and control.

OBJECTIVES

- To have knowledge about the World of micro organisms and microscopy
- To study the Structure and replication concepts of microorganisms
- To know the requirements of Microbial nutrition for growth of micro organisms and the impact of environment on its growth
- To understand the mechanism of Microbial metabolism and the clinical importance of micro organisms
- To evaluate the Control of micro organisms and its environmental applications.

UNIT I

WORLD OF MICRORGANISMS AND MICROSCOPY

Characteristics of micro organisms, Historical review of the foundation of microbiology, Taxonomy methods of studying microorganisms, Microscopy – Light, Electron, Phase Contrast and Laser optics systems, Micrometry.

UNIT II

STRUCTURAL ORGANIZATION AND REPLICATION OF MICRO ORGANISMS

General structural organisation of Bacteria and Viruses, Differentiation and development. Multiplication of Bacteriophages, Eukaryotic microorganisms such as Yeast – Cellular organization and reproduction.

UNIT III

MICROBIAL NUTRITION AND ENVIRONMENT

Nutritional requirements, Growth of micro organisms in different methods of enumeration of multiplying micro organisms, Methods of preservation of microbes, Effects of physical and chemical factors on microbial growth.

UNIT IV

MICROBIAL METABOLISM AND CLINICAL MICROBIOLOGY

Metabolic pathways and bioenergetics, Aerobic and anaerobic growth, Production of secondary metabolites and their application in industry, Beneficial micro organisms and products, Clinically

important micro organisms and their effects on infections and immunity formation of toxic materials by micro organisms. Their role in clinical microbiology and food preservation.

UNIT V

CONTROL OF MICRO ORGANISMS AND ITS ENVIRONMENTAL APPLICATIONS

Drug, Chemotherapy, Antimicrobial agents and disinfectants, Diseases caused by micro organism and control, Ecology, Recycling of biomaterials, Production of biogas, Leaching of ores by micro organisms, Biofouling, Application of Biofertilizers and Biopesticides, Microbes in air, Drinking water and waste water, Pollution control through use of consortium of micro organisms, Microbial indicators, Food poisoning, Food spoilage.

TEXT BOOKS

1. Pelzar, M.J., Chan, E.C.S and Krieg, N.R. Microbiology. *Tata Mc Graw Hill Edn.*, New Delhi, India.
2. Prescott, Harley and Klen, 2003. Microbiology. *Mc Graw Hill Publications*. 5th Edn.
3. Ananthanarayan and Jayaram Paniker, 1999. Text Book of Microbiology. *Orient Longman Publishers*.

REFERENCES

1. Talaro, K., Talaro A., Cassida Pelza and Reid, 1993. Foundation in Microbiology. *W.C. Brown Publishers*.

GENETICS

AIM

The course is aimed to make the student knowledgeable about the Basic concepts of Genetics

OBJECTIVES

- To understand the Basic concept of Classical Genetics through Mendelian experiment
- To study the Structural organization of chromosome
- To know the Genetical disorders with reference to alleles
- To impart knowledge on Linkage and crossing over
- To learn the mechanism of Genetic transfer.

UNIT I

BASIC OF GENETICS

Classical Genetics, Mendelian Laws, Mendel's Experiment Monohybrid and Dihybrid Inheritance.

UNIT II

KARYOLOGY

Chromosome structure and Organization in Prokaryotes and eukaryotes.

UNIT III

ALLELES

Classical concept of allelomorphism – Problems, Multiple alleles, Sex linkage in Drosophila, Sex linked lethal in Drosophila – Sex linkage in Human beings, Colour blindness, Haemophilia, Blood group antigens.

UNIT IV

LINKAGE AND CROSSING OVER

Coupling and Repulsion – Hypothesis, Test cross in Maize and crossing over, Sex Chromosomes, Sex linked inherited disorders, Linkage, Crossing over and Genetic mapping of chromosomes.

UNIT V

GENETIC TRANSFER

Identification of the Genetic material – Classical experiments, Hershey Chase, Avery McLeod etc., Conjugation, Transduction and Transformation, Transposons.

TEXT BOOKS

1. Verma, P.S. and Agarwal, V.K., 2005. Genetics. *S. Chand Publication*.
2. Winter, P.C., Hickey, G.I. and Fletcher, H.L., 2003. Instant Notes in Genetics. 2nd Ed., *Viva Book Pvt. Ltd.*

REFERENCES

1. Goodenough, U., 1985. Genetics. *Hold Saunders International*.
2. Gardner, E.J., Simmons, M.J. and Slustad, D.P., 1991. Principles of Genetics.
3. Stanly R. Maloy, John E. Cronan and David Freifelder, Jr., 2006. Microbial Genetics. Narosa Publishing House.

INTRODUCTION TO BIOTECHNOLOGY

AIM

To impart knowledge on the fundamentals, basic concepts and principles involved in Biotechnology.

OBJECTIVES

- To discuss about the scope and importance of Biotechnology and its current status in our country
- To learn the principles involved in the General and Industrial Biotechnology
- To have a knowledge on the role of Biotechnology in agricultural and environmental management
- To understand the mechanism involved in Process technology and Microbial production
- To have a discussion about the applications of Biotechnology in Human welfare and its ethical implications.

UNIT I

INTRODUCTION

Biotechnology : An overview – What is biotechnology? Biotechnology, an interdisciplinary pursuit, Old and New Biotechnology, Scope and importance, Commercial potential, Public perception of Biotechnology, Biotechnology in India.

UNIT II

GENERAL AND INDUSTRIAL BIOTECHNOLOGY

Isolation and screening of micro organisms, Bioreactors, Process development, Scale up and Media design for fermentation process, Food and Beverage fermentation, Enzymes and Food processing, Immobilization of enzymes, Biotransformations, Production of Single cell Protein (SCP), SCP derived from Algae, Wastes, Agricultural crops and Economic implications of SCP, Production of Bioethanol and Biodiesel, Biosensors.

UNIT III

BIOTECHNOLOGY IN AGRICULTURE AND ENVIRONMENT

Biotechnology methods of crop improvement, Plant tissue culture, Genetic transformation, Transgenic plants, Applications of Transgenic plants, Transgenic animals, Novel and Better, Bioinsecticides, Biofertilizers, Contributions of Biotechnology in Waste water treatment and Environmental management, Biodegradation of Xenobiotic compounds.

UNIT IV

PROCESS TECHNOLOGY AND MICROBIAL PRODUCTION

Process technology for the Production of Cell biomass and some Primary metabolites, e.g. Ethanol, Acetone-Butanol and Citric acid, Microbial production of industrial enzymes-Glucose isomerase, Cellulase etc., Production of secondary metabolites-Penicillin, Tetracycline etc.

UNIT V

BIOTECHNOLOGY IN HUMAN WELFARE AND ETHICS

Conventional vaccines, Recombinant vaccines, DNA vaccines, Monoclonal antibodies and Detection of Genetic Diseases, Interferons, Drug designing, Gene therapy, Forensic medicine applications of Human Genetic Research. Biotechnology : Legal aspects - Genetically Manipulated Organisms and environment, Biosafety, Social, Moral and Ethical consideration.

TEXT BOOKS

1. Kumar, H.D. Modern Concepts and Biotechnology. *Vikas Publishing House Pvt. Ltd.*
2. Gupta, P.K. Elements of Biotechnology. *Rastogi Publications.*
3. Jogdand, S.N., 2003. Environmental Biotechnology. *Himalaya Publishing House.*
4. Satyanarayana, 2005. Biotechnology.

REFERENCES

1. John E. Smith. Biotechnology. *Cambridge Press.* 3rd Edn.
2. Glazer A. and Noickaido, 1995. Microbial Biotechnology – Fundamentals of Applied Microbiology.
3. www.techport.ac.uk/tud/bd/univpo.

UNIT OPERATIONS

AIM

To make students understandable about the fundamentals, principles and concepts of Heat transfer and Mechanical operations in Biochemical process.

OBJECTIVES

- To have an exposure about the principles and mechanism of Heat transfer
- Fundamentals of convective Heat transfer
- Principles of Heat exchanger design
- Basic concepts of Drying
- The theory behind Mechanical separation and its significance in Bioprocesses.

UNIT I

CONDUCTION

Mechanism of Heat transfer – Heat conduction – Conduction through series resistance – Combined conduction – Convection – Extended surfaces – Two dimensional conduction – Shape factors.

UNIT II

CONVECTION

Convection – Dimensional analysis – Forced convection in pipe and other geometrics – Natural convection – Boiling and condensation – Heat transfer to Non – Newtonian fluids.

UNIT III

HEAT EXCHANGER

Heat Exchangers – Design – Evaporators – Overall Heat transfer coefficients – Calculation for Single and Multiple effects.

UNIT IV

DRYING

Drying – Air properties – Drying equipments – Types of Driers – Drying rates and Drying time.

UNIT V

MECHANICAL SEPARATION

Filtration – Industrial filter – Design – Centrifugal separation – Settling and sedimentation.

TEXT BOOK

1. Christie J. Geankoplis. Transport Processes and Unit Operations. *Prentice Hall India Pvt. Ltd.*, 3rd Edn.

REFERENCES

1. Robert E. Treybal. Mass Transfer Operations. *Mc Graw Hill International*, 3rd Edn.
2. Mc Cabe, W.L. and Smith, J.C. Unit Operations in Chemical Engineering. *Mc Graw Hill International Edn.*
3. Frank P. Incropera, 1998. Fundamentals of Heat and Mass Transfer and Interactive Heat Transfer. *John Wiley Sons.*

BIOCHEMISTRY LAB

AIM

To develop the skills of the students by providing hands on training in various Biochemical investigations.

OBJECTIVES

At the end of this laboratory course, the student would have learnt about the Qualitative analysis, Biochemical investigations, Thin Layer Chromatography.

1. Guidelines for using Biochemistry Lab (Theory)
2. Concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Accuracy, Precision, Sensitivity and Specificity (Theory)
4. Preparation of Buffer – Titration of Weak acid and a Weak base.
5. Qualitative test for Carbohydrates – Distinguishing reducing from non – reducing sugars and keto from aldo sugars.
6. Quantitative method for Amino acid estimation using Ninhydrin –Distinguishing amino from imino acid.
7. Protein estimation by Biuret, Lowry's, Bradford and Spectroscopic methods.
8. Extraction of Lipids and analysis by TLC.
9. Estimation of Nucleic acids by absorbance at 260 nm and Hyper chromic effect (Demo).
10. Enzymatic assay : Phosphatase from Potato.
11. Enzymatic assay : Estimation of Glucose by TGO method after hydrolysis of Starch with Acid and Specificity of the enzymatic method.

MICROBIOLOGY LAB

AIM

To give an opportunity of verifying the theoretical concept by experimentally in a more explicit and concentrated manner.

OBJECTIVES

The students should understand the basic concepts of Microbiology, Develop their skills in the Preparation, Identification and Quantification of micro organisms.

EXPERIMENTS

1. Sterilization Techniques.
2. Culture Media Preparations
 - a. Broth Type Media
 - b. Agar.
3. Culturing of Micro organisms
 - a. Pure Culture techniques
 - Streak Plate
 - Pour Plate.
4. Isolation, Enumeration and Purification of Microbes from a given sample.
5. Preservation of Bacterial Culture.
6. Identification of Micro organisms
 - a. Staining techniques
 - Simple
 - Gram
 - Spore
 - Hanging Drop
 - b. Biochemical testing.
7. Quantitation of Micro organisms
 - a. Microscopy and Micrometry
 - b. Nephelometry / Turbidimetry
 - c. Dry Weight
 - d. Serial Dilution Plating.
8. Environmental Sample Analysis
 - Quantitative Estimation of Pathogenic and non-Pathogenic Microbes from Sewage and Soil samples.

9. Food Microbiology

- Milk
- Fermented Food
- *Salmonella* in Poultry.

10. Clinical Microbiology

- Normal Mouth Flora
- Blood and Urine Culture
- Antibiotic Disc Test Assay.