



Semester – I

BRANCH	Subject	Subject Code
B.Sc. (Biotechnology - Major)	Cell Biology and Biochemistry	BTM1-111

Course Objective:-The Main Objective of the course will be to build the basic foundation for studying Biotechnology. The Demand for Trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The restructured syllabus combines basic principles of Chemical and Biological sciences in light of advancements in technology. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field.

Course learning outcomes (CLO):-

1. Understand the basic of cell biology.
2. Appreciate the importance of bonding spatiel arrangement of molecules of proper function and stability.
3. Understand both the physical as well as chemical properties of biomolecules.
4. Students can pursue a career in biochemical testing. The decrease of increase in the amount of some of the biomolecules can have clinical significance.
5. Students can also go in for medical laboratory tech courses. Opening opportunities of hospital and pathology laboratories.

Unit - I

Cell as a Basic Unit:

1. Historical background of the Cell

- 1.1 History of Cell Biology.
- 1.2 Cell Structure.
- 1.3 Cell Theory.

2. Prokaryotic Cell and Cell Organells:

- 2.1 Ultrastructure of Prokaryotic Cell.



2.2. Structure and function of cell organelles: Flagella. Pili. Cell wall. Cytoplasmic membrane, nuclear region. Ribosomes, Vacuoles, Metachromatic granules, Spores and Cysts. Microtubules. Microfilaments, Centriole.

2.3 Difference between Prokaryotic and Eukaryotic cells.

Unit - II

Cell Organelles and Cell Cycle:

1. Eukaryotic Cell and Cell Organelles:

1.1 Ultrastructure of Eukaryotic cell (Plant and Animal cells).

1.2 Structure and function of cell organelles: Cell membrane, Mitochondria.

Chloroplast, Endoplasmic reticulum, Golgi bodies. Lysosomes.

Peroxisomes, Nucleus.

2. Cell Cycle:

2.1 Cell cycle and Cell division.

2.2 Apoptosis or Cell death .

Unit - III

Molecular Structure of Water:

1. Water structure and Buffer:

1.1 Properties of Water.

1.2 Interaction of Water.

1.3 Role of Water in Bio molecular Structure.

1.4 Acid and Bases, Buffer solutions.

2. Chemical Bonds:

2.1 Chemical Bonds (Ionic Bond, Covalent Bond, Coordinate Bond. Non Covalent Bonds, Hydrogen Bond)

Unit - IV

Biomolecules: Sources, Nomenclature, Classification. Structures, Characteristics, and



Functions:

1. Carbohydrates,
2. Lipids,
3. Proteins and Nucleic Acids.

Unit - V

Tools and Techniques

1.1 Principle and Applications of Light Microscopy, Centrifugation. Chromatography (Paper. Thin layer and Column), Colorimeter and Spectrophotometer.

List of Experiments/Exercise (Practicals)

1. To study the plant cell structure using various plant materials.
2. To study the animal cell structure using cheek cells.
3. To Prepare Onion root tip for the stages of Mitosis.
4. To Prepare and study the different stages of Mitosis and Meiosis.
5. To analyze Carbohydrates Quantitatively.
6. To analyze proteins quantitatively
7. To analyse lipids Quantitatively
- 8 To Prepare Buffers.
9. To Separate plant pigments by Paper Chromatography
- 10 To Separate amino acids by TLC analyze lipids quantitatively



Semester – II

BRANCH	Subject	Subject Code
B.Sc. (Biotechnology - Major)	Microbiology and Immunology	BTM1-121

Course Objective: - Course Objectives: To create general understanding about microbiology and immunology

1. The students will be able to understand microbial diversity and Nutrition.
2. The students will be able to understand immune system. Immune responses and Vaccination.
3. The students will be able to describe role of immune system in both maintaining health and contributing to disease.
4. The students will be able to understand immunological techniques.

Course Learning Outcomes: At the end of the course student will familiar with -

1. Microbial diversity and nutrition.
2. Immune system, its properties and types.
3. Immunoglobulin structure, types and functions and can apply the concept of hypersensitivity and vaccination for different diseases.
- 4 Perform various immunological techniques.

Unit - I

History, Basic concepts of Microbiology and Culture Media preparation

1. History, Basic concepts of Microbiology:

1.1 Fundamental, History and evolution Development of microbiology. Application of microbiology in human welfare.

1.2 Classification, General characteristic and structure of Bacteria, Fungi and Viruses.

2. Media Preparation:

2.1 Methods and Types: Culture, Minimal, Selective, differential. Transport media.

2.2 Synchronous, Batch and Continuous culture.



Unit - II

Microbial Growth and Growth measurement:

1. Microbial Growth:

1.1. Definition of growth, Mathematical expression of growth Curve, Generation time, Growth yield. Effect of nutrients on growth.

1.2. Factor affecting growth: Nutrient, Temperature, Oxygen, pH, Osmotic pressure.

2. Growth measurement:

2.1 Measurement of Growth (Direct and Indirect methods): cell number, Cell Mass and Cell Activity.

2.2. Cell Count: Turbidometric method, Plate count method. Membrane count method. Dry weight and Wet method by measurement of cellular activity.

Unit - III

Basics of Immunology:

1. Basics of Immunology:

1.1. Concept of Innate and Acquired immunity. Phagocytosis complement and inflammatory responses.

1.2. Immune cells and organs: Structure, Function and Properties of immune cells - Stem cell, T-cell, B-cell, NK-cell, Macrophages, Neutrophil. Eosinophil Basophil, Mast cell, Dendritic cell.

1.3. Immune organ: Bone marrow. Thymus, Lymph Node, Spleen, Lymphatic System.

Unit - IV

Immunoglobulins and Immune response:

1. Immunoglobulins

1.1. Antigens: Characteristics of an antigen: Foreignness. Molecular size. Chemical composition and Heterogeneity.

Antigen Adjuvants, Epitopes, Haptens.

1.2. Antibodies: Structure, Types, Functions and Properties of antibodies Antigenic determinant on antibodies (Isotypic, Allotypic, Idiotypic). Monoclonal, Polyclonal and Chimeric antibody.

2. Immune response:



2.1. Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Memory cell).

Generation of cell mediated immune response (self MHC restriction, T-cell activation, Co-stimulatory signals). Killing Mechanisms by CTL and NK cells, Introduction to tolerance.

Unit - V

Microbial, Immunological Techniques and Vaccination:

1. Microbial Techniques :

1.1. Principle, Working and applications of instruments -Laminar airflow, Autoclave, Hot air oven.

2. Immunological techniques:

2.1. RIA, ELISA, Western blotting. Principles of Precipitation.

Agglutination, Immunodiffusion, Immunolectrophoresis.

3. Vaccination and Disease:

3.1. Vaccines and vaccination: Rubella, Varicella (Chickenpox). Polio, Diphtheria, Hepatitis vaccine.

3.2 Genetic disorder – Anemia, Sickle cell anemia, Thalassemia

List of Practical's

- 1 To perform Aseptic technique, Cleaning of glassware's, preparation of Cotton Plugging and Sterilization.
2. To prepare Bacterial and Fungal media.
3. To isolate microbes from Air, Water and Soil.
4. To Study dilution and plating by Pour Plate, Spread Plate methods.
5. To Study microorganisms by Staining method - Simple staining, Gram staining. Endospore staining, Fungal staining. Negative staining
6. To identify bacteria based on staining, Shape and Size.
7. To enumerate microorganism - Total and Viable count.
8. To study Antibiotic sensitivity of microbes by the use of antibiotic discs.
9. To isolate and identify pathogenic bacteria from sewage and waste water.



10. To Determine growth curve and generation time of E. coli.
11. To identify of human blood groups.
12. To enumerate total WBC of the given blood sample by hemocytometer.
13. To enumerate differential Leukocyte of the given blood sample.
14. To enumerate total RBC of the given blood sample by hemocytometer.
15. To isolate and Identify aquatic Fungi from Local water body.