

## M. Sc., Biochemistry Course and Program Outcome

### PROGRAM SPECIFIC OUTCOMES

Overall, the program will help to,

- 1: Produce knowledgeable, trained and skilled postgraduates in the area of biochemistry and molecular biology.
- 2: Equip the postgraduates to take up innovative research in various branches of modern life sciences.
- 3: Acquire knowledge and skills to undertake a career in research either in industry or in an academic set up
- 4: Train the students for exploiting various biochemical and molecular biology tools to contribute towards newer areas of disease forecasting and diagnosis.
- 5: Contribute to the area of Biomedical science and education, Agriculture and Pharmaceutical Industries.
- 6: Apply the knowledge of experimental approaches to solve problems in the field of core biochemistry
- 7: Integrate and apply the techniques in Analytical biochemistry, Protein chemistry, Clinical biochemistry, Microbiology, Molecular biology and Bioinformatics.
- 8: Acquire scientific knowledge in Cell biology, Clinical Biochemistry, Molecular Biology, Analytical Biochemistry, Immunology, Enzymology and Genetic engineering.
- 9: Obtain awareness of the biochemical basis of human diseases, non-invasive diagnostics and drug development.
10. Provide the basis to contribute in the newer emerging areas such as personalized medicine, gene therapy and genome editing.

### **Semester I: Paper Title - BC-1.1: ANALYTICAL BIOCHEMISTRY.**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Acquire knowledge to prepare solutions of different concentrations and analyse them spectrophotometrically in biological samples.
- 2: Understand the concept of testing and separation of analytes by chromatographic methods
- 3: Comprehend the theories and practical knowledge of separation of biological samples by various electrophoretic techniques
- 4: Acquire knowledge of cell culture system and techniques associated with microscopy and centrifugation.

5: Practically learn the concept of preparation of standards curves and perform quantitative estimations

6: Isolate biomolecules from biological samples and perform purity analysis by HPLC or TLC.

### **Semester I Paper Title- BC-1.2: BIOMOLECULES**

**Course Outcome: After successful completion of this course, students will be able to**

1: Understand the classification, structure and function of biomolecules, the building block of cells.

2: Visualize the important biochemical processes and molecular events

3: Design the experiments to characterize the biomolecules based on its chemical nature

4: Develop the strategies to exploit the biomolecules for the benefit of mankind

### **Semester I Paper Title - BC-1.3: CELL BIOLOGY AND GENERAL MICROBIOLOGY**

**Course Outcome: After successful completion of this course, students will be able to**

1: Acquire knowledge about ultrastructure and dynamics of different cell types

2: Understand the knowledge of membrane dynamics and transport system at cellular levels

3: Understand the concepts of cell division and functioning of different types of cells

4: Comprehend the history of Microbiology, types of microbes and their classification.

5: Learn microscopic examination of microbes, growth of microbes, nutritional requirements and growth curve.

6: Isolate pure cultures, enumeration and characterization of microbes by biochemical tests.

7: Understand the life cycle of viruses, bacteria and fungi and get acquainted with the genetics of viruses and bacteria.

8: Perform sterilization, preparation of culture media and plating technique (liquid and solid), culture, store and preservation of microbial strains.

9: Learn how to isolate microbes from soil, mouth flora and water samples and prepare pure cultures using streak plate and pour plate methods

10: Carry out growth curve measurement of bacterial population by turbidometry/Colony Forming Unit methods and various staining techniques.

## **Semester I Paper Title- BC-1.4: FUNDAMENTALS OF BIOCHEMISTRY**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Understand the fundamental concepts of biology, chemistry and biochemistry.
- 2: Apply basic principles of chemistry to biological systems and molecular biology.
- 3: Relate various interrelated physiological and metabolic events.
4. Comprehend the occurrence and role of heterocyclic compounds in biological system
5. Understand the concept of thermodynamics in biological systems
6. Appreciate the importance of water and metal ions in biological systems

## **Semester II Paper Title - BC-2.1: ENZYMOLOGY**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Understand the concept of catalysis and classification of enzymes in particular.
- 2: Comprehend enzyme kinetics and derive equations for various orders of enzyme catalysis.
- 3: Know the mechanism of enzyme catalysis in the presence and absence of inhibitors
- 4: Understand the various levels of regulation of enzyme activity, assay of enzyme catalysed reactions and determination of  $V_{max}$  and  $K_m$  values.
- 5: Differentially assay the isoenzymic forms of an enzyme
- 6: Partially purify enzyme in the nature form and assess its yield and purity

## **Semester II Paper Title - BC-2.2: METABOLISM OF FUEL MOLECULES AND BIOENERGETICS**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Imbibe the knowledge above the relevance of thermodynamic principles in the living system
- 2: Comprehend the energy transduction and the spontaneity of the living system
- 3: Understand the catabolic and anabolic process of carbohydrate and its reciprocal regulation
- 4: Appreciate the role of carbohydrate in biological functions, beyond the production of ATP
- 5: Know nutrient sources turning into metabolic energy and the associated metabolic flux
- 6: Know the causes, effects and mitigation of various lipid and carbohydrate metabolic disorders

## **Semester II Paper Title - BC- 2.3: HUMAN PHYSIOLOGY AND NUTRITIONAL BIOCHEMISTRY**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Apprehend the role of various digestive secretions in the process of digestion of food components and absorption mechanisms
- 2: Know the composition of blood, metabolism of haemoglobin, clotting mechanisms and the connective tissue components
- 3: Understand the mechanism of respiration, factors influencing interaction of carbon dioxide and oxygen with haemoglobin. Water, electrolyte and acid – base balance mechanisms
- 4: Understand xenobiotics and detoxification mechanisms of liver. Nerve impulse generation and transmission across and between neurons
- 5: Understand the mechanisms involved in muscle contraction and relaxation, photochemistry of vision, hormone production and their action
- 6: Acquire knowledge about nutrition, importance of vitamins and minerals in diet
- 7: Understand the concepts of and macro micronutrients in the context of human physiology

## **Semester II Paper Title - BC- 2.4: ENZYME PURIFICATION TECHNIQUES (ELECTIVE)**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Know the concept of enzyme catalysis and their classification
- 2: Comprehend enzyme kinetics and derive equations for enzyme catalyzed reactions.
- 3: Understand the principle behind various chromatographic and electrophoretic techniques.
- 4: Decide the techniques to be applied for the purification of enzymes and determination of the purity of the isolated enzyme
- 5: Perform isolation of certain commercially important enzymes

## **Semester III Paper Title- BC-3.1: MOLECULAR IMMUNOLOGY AND CLINICAL BIOCHEMISTRY**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Understand the immune system, kinds of immune responses, innate and adaptive immunity
- 2: Comprehend the role of primary lymphoid organs and secondary lymphoid organs in immunity, development of B and T cells, role of MHC in antigen presentation

3: Understand humoral immunity, structure of immunoglobulins, antibody classes, antibody diversity, cytokines, monoclonal antibodies and principle behind immunological techniques

4: Understand cell mediated immunity, MHC and immune response. B and T cell maturation, activation and differentiation.

5: Understand hypersensitive reactions, kinds, immunodeficiency disorders, kinds, transplantation immunology

6: Acquire knowledge about disorders associated with GIT secretions

7: Understand the biochemical aspects of mental and neurological diseases

8: Understand the concepts of liver and kidney function tests and haematological analyses.

### **Semester III Paper Title- BC- 3.2: BIOCHEMICAL GENETICS AND MOLECULAR BIOLOGY**

**Course Outcome: After successful completion of this course, students will be able to**

1: Acquire knowledge about Mendelian and non-mendelian inheritance

2: Understand the concepts of chromosomal aberrations and mechanisms of recombination

3: Understand the concepts gene mapping , pedigree drawing

4: Acquire knowledge of gene silencing mechanisms

5: Acquire knowledge about DNA replication, transcription, translation and DNA repair

6: Acquire knowledge of co-transcriptional and post-translational modifications and regulation of gene expression

### **Semester III Paper Title - BC- 3.3: METABOLISM OF NITROGENOUS COMPOUNDS WITH CLINICAL CORRELATIONS**

**Course Outcome: After successful completion of this course, students will be able to**

1: Recognize how fundamental chemical principles and reactions are utilized in biochemical processes.

2: Judge whether a proposed or hypothetical reaction is consistent with the general framework of catabolic and anabolic metabolism.

3: To have a knowledge of degradation and biosynthesis of individual amino acids, purine and pyrimidine bases

4: Understand the defects in amino acid, nucleotide and heme metabolic pathways leading to various disorders

5: Role of marker enzymes in clinical diagnosis of various disorders

#### **Semester IV Paper Title- BC-4.1: CELL SIGNALLING**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Understand the basic principles of signal transduction mechanisms, in particular the concepts of response specificity, signal amplitude and duration, signal integration and intracellular location
- 2: Give examples of different types of extracellular signals and receptors, and explain their functional significance
- 3: Describe the mechanisms by which different receptors may be activated by their respective ligands
- 4: Describe and give examples of the structure and properties of the major components of signal transduction pathways.

#### **Semester IV Paper Title- BC-4.2: GENETIC ENGINEERING AND INDUSTRIAL BIOTECHNOLOGY**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Understand recombinant DNA technology and the stepwise methodology to achieve it
- 2: Learn the concept of generating DNA libraries and various DNA transfer methods.
- 3: Get an idea of nucleic acid labelling techniques and their application in genetic engineering.
- 4: Understand the design and operation of different types of fermenters, downstream processing and recovery of fermentation products
5. Know the principle of microbial production of antibiotics, alcoholic beverages and vitamins
- 6: Analyze the quality of water, BOD and effluent treatment methods

#### **Semester IV Paper Title- BC - 4.3: BIOSTATISTICS, BIOINFORMATICS AND NANOBIO TECHNOLOGY**

**Course Outcome: After successful completion of this course, students will be able to**

- 1: Develop skills to perform statistical analysis of population studies
- 2: Understand how to design sample analysis and perform chi square, Fischer exact and multivariate analysis
- 3: Demonstrate a good understanding of measures of correlations
- 4: Knowledge and awareness of the basic principles and concepts of biology and computer science

5: Use the existing online software effectively to extract information from large databases and to use this information in computer modelling

6: Familiarise with working principles, tools and techniques in the field of nanomaterials.

7: Understanding of the strengths, limitations and potential uses of nanomaterials and biosensors