M.Sc. Biochemistry

Program Outcomes

PO1: To demonstrate academic, personal, behavioural and social competencies

PO2: To employ practical skills and techniques for development of entrepreneurial competenies

Program Specific Outcomes

PSO1: Understand the molecular structure and conformation of proteins, lipids, nucleic acids, and carbohydrates and their role in the metabolic functions of the organism.

PSO2: Explain the biochemical processes and metabolic processes that underlie the cellular physiology of eukaryotic and prokaryotic cells.

PSO3: Demonstrate an understanding of the principles of inheritance and explain the relationship between genomics and proteomics.

PSO4: Utilize biochemical and molecular techniques to conduct experiments to test scientific hypotheses, analyze data, trouble-shooting and draw conclusions from the experimental data.

PSO5: Employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of experiments using the discipline standards for reporting and citation.

Course Outcomes

FIRST SEMESTER

Biomolecules

CO1: Classify and elucidate carbohydrates based on structure and physicochemical properties. Exemplify the relation between the structure and function of polysaccharides.

CO2: Understand the classification, functions, and application aspects of lipids.

CO3: Classify amino acids and proteins based on their structure and function, application of Ramachandran plot in understanding protein structure.

CO4: Interpret molecular structure and interactions of nucleic acids, significance and methodology involved in characterizing nucleic acids.

Microbiology

CO1: Define the basic principles of bacteriology including structures of cell membranes, cell walls and different sub structures of bacteria.

CO2: Understand and define the different factors required for microbial growth and reproduction

CO3: Classify and describe different properties of viruses, also demonstrate the knowledge of viral replication

CO4: Describe the characteristics of foodborne microorganism and explain the techniques for food preservation

CO5: Explain the interactions between microorganisms and the environment and define their role in biological waste treatment

CO6: Impact knowledge about steps involved in bioprocess, with a focus on the role of microorganisms, their products, the design and operation of industrial practices.

Metabolism I

CO1: Understanding the concept of generation of metabolic energy, basic concepts of Bioenergetics, high energy compounds and their significance.

CO2: Elucidating the mechanisms of oxidative phosphorylation, electron transport chain, synthesis of ATP under aerobic and anaerobic conditions.

CO3: Acquire knowledge related to carbohydrate metabolism and their regulations. Students will be exposed with the fact that perturbations in the carbon metabolism can lead to various disorders such as diabetes.

CO4: To gain insights into metabolic energy produced from the ft metabolism, formation of membrane lipids and to study the significance by correlating with disorder of lipids.

Human Physiology

CO1: Introduce the basic structure and functions of tissues to study the cell-cell interaction.

CO2: Describe the elements and mechanism of cytoskeleton to maintain cell integrity.

CO3: Study of muscle structure for a better understanding of contraction and relaxation process

CO4: Knowledge of brain, its cell types and biochemical aspects involved in transmission of impulses

CO5: A thorough study on body fluids, its functions and regulation

CO6: Outline the key steps in digestion and absorption of macromolecules.

CO7: Acquire knowledge on work of breathing and its regulation

CO8: Analyze the coordinated responses to maintain homeostasis

CO9: Explain biochemical events involved in image formation.

Organic Chemistry

CO1: Understand the different types of reactions involving a biomolecule.

CO2: Empower the students' knowledge at the atomic level with electron orientations which aid them in understanding the drug discovery programme.

CO3: Acquire knowledge of different synthetic reagents and reactions of the drug discovery programme.

SECOND SEMESTER

Biochemical Techniques

C01: Ability to explain, and evaluate principles of chromatography in industry.

C02: Knowledge of operating principles and handling of varied centrifuges.

C03: Describe the different types of electrophoresis used in separation methods.

C04: Outline the principle and practical application of radio-isotope labelling processes in the biological system.

C05: Discuss and demonstrate the working knowledge of spectrophotometric techniques and its application in industry.

Nutritional and Clinical Biochemistry

CO1: Understand the energy requirements of nutrients and their applications for normal health.

CO2: Describe the different types, physicochemical properties, and physiological actions of simple and complex carbohydrates

CO3: Study the protein reserves and understand its requirement at different stages of human development

CO4: Define protein nutritional deficiency in the clinical lab diagnosis of metabolic diseases

CO5: Classify and describe the metabolism of dietary lipids

CO6: Identify the body's main fluid compartments and describe the irregularities associated with it

CO7: List the nutritional significance of minerals in the human body

CO8: Identify dietary sources of vitamins and describe the specific deficiency diseases associated

CO9: Define the scientific definition of obesity and various body fat distribution patterns, related diseases, and management of eating disorders

CO10: Acquire knowledge of the clinical consequences of disorders of liver, kidney, and thyroid

CO11: Analyze clinical management and the control of disorders by various function tests using diagnostic enzymes

Metabolism II

CO1: To study the significance of the nitrogen cycle in fixing atmospheric nitrogen and the role of microorganisms in nitrogen fixation and its regulation.

CO2: Understanding the role of assimilation of ammonia and demonstrating different oxidative pathways of amino acid and its regulation. Enhancing the knowledge in the field of amino acids through special metabolic pathways of amino acids and their metabolic disorders.

CO3: Describing the metabolism and regulation of nucleic acids and their related diseases.

CO4: Elucidating the significance of heme metabolism by correlating with metabolic disorders.

Enzymology

CO1: Classify and characterize the enzymes in each enzymatic class.

CO2: Understand the structure and functional relationships in biocatalyzed reactions.

CO3: Predict strategies for the analysis of kinetic mechanisms of enzyme-catalyzed reactions

CO4: Elucidate possible catalytic mechanisms of given reaction types.

CO5: Analyze the enzyme inhibitory and regulatory mechanisms.

CO6: Employ the potential clinical and industrial applications of enzyme systems.

Biochemical Toxicology

CO1: Introduction to the various facets and the common terminologies used in the study of toxicology.

CO2: Interpretation of the principles, factors affecting the disposition of toxins and application of antidotal therapy.

CO3: Elucidate the mechanisms of mutagenesis, carcinogenesis, and teratogenesis and demonstrate bioassay procedures involved in detecting toxicity.

CO4: Classification of the various types of toxins, their origins and health implications of toxic exposures.

CO5: Knowledge of various food additives, animal and plant toxins and their impact on health.

CO6: Understanding the physiological impact and risk factors affecting metal toxicity.

Research Methodology

C01: Introduction to different types of research and their importance.

C02: Define appropriate research problem, organize and conduct research in a structured manner.

C03: Outline the types of measurement scales in the research process.

C04: Knowledge of intellectual property rights

C05: Enable students to prepare a project proposal, to write a research report, articles and thesis in a decipherable manner.

C06: Emphasis on tools in data handling

Developmental Biology (Tutorial)

CO1: Study on stem cell types emphasizing medical applications

CO2: Knowledge of model organisms will provide insight into the workings of other organisms and facilitate research on human experimentation that would be unfeasible or unethical.

CO3: Identify the cellular behaviours that lead to morphological change during development and the hierarchy of gene activation that occurs in early Drosophila development.

CO4: Understand how embryonic stem cells and their alternatives can be used in medical treatments.

THIRD SEMESTER

Immunology

CO1: Develop an understanding of the function and mechanism of host defense for maintaining homeostasis.

CO2: Compare and contrast the structure and function of immunoglobulins, their production and application.

CO3: Outline key events and cellular players in complement activation.

CO4: Understand the principles governing vaccination and the mechanisms of protection against infectious diseases.

CO5: Conceptualize how the innate and adaptive immune responses coordinate to fight invading pathogens.

CO6: Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses

CO7: Understand and explain the basis and immunomodulatory strategies in immunological tolerance, hypersensitivity, autoimmunity, immunodeficiency, transplantation, the immune system in cancer and the principles of immunotherapy.

CO8: Describe and employ antigen-antibody interactions in different immunological and serological tests in the laboratory.

Plant Biochemistry

CO1: Understand the characteristics and composition of seeds and the basic requirements of plant growth

CO2: Define and classify the major and trace plant nutrients. To study related deficiencies

CO3: Outline the roles of different plant hormones and define their biosynthetic pathway

CO4: Explain the process and the types of photosynthesis

CO5: Understand the characteristics of a few natural products, their synthesis and their uses.

CO6: Define the structure, source and biological importance of phytochemicals

CO7: Classify and describe concepts of terpenes and their biological significance

CO8: Understanding chemical ecology of defense in plants

CO9: Explain the major interactions between plant physiological state and the environment under stress conditions

CO10: Describe the process of gene transfer and expression in plants using vectors

Molecular Biology - I

CO1: To provide an insight into the tools of the replication process and to differentiate between prokaryotes and eukaryotes.

CO2: Understand genotoxic, cytotoxic and mutagenic damages caused due to chemical alterations in DNA and focus on their repair mechanisms.

CO3: Knowledge of the viral replication that will aid in the development of newer tools to improve the health of humans and animals.

CO4: Provide detailed knowledge about the functioning of a cell at the molecular level with respect to promoters, transcriptional factors and transcript processing.

CO5: Describe the qualities of the genetic code in determining the amino acid sequence of a polypeptide.

Cell and Membrane Biology

CO1: Understand membrane structure, physicochemical properties, functions and the various techniques used in membrane study.

CO2: Demonstrate the types of membrane transport and their underlying mechanism.

CO3: Analyze the importance of protein sorting, targeting and degradation.

CO4: Predict and compare the process and organization of signal transduction pathways.

CO5: Elucidate the general mechanism of cell division and their regulation through different checkpoints of the cell cycle and its control through apoptosis.

Cancer Biology (Tutorial)

CO1: Understand the cellular mechanisms leading to the initiation and progression of cancer growth and define the role of oncogenes and mutations in cancer

CO2: Explore the molecular pathways responsible for genome instability in cancer cells and the role of apoptosis in cancer

CO3: Analyze the cellular targets and molecular mechanisms of traditional and novel cancer therapies.

Molecular Endocrinology

CO1: Introduction to Endocrine glands-structure and function, endocrinal hormones and their classification.

CO2: Understanding the synthesis of different hormones, secondary messenger and their signal transduction pathway.

CO3: A conceptual approach to understanding the hormonal regulation of a particular physiological activity, irrespective of its diversity in order to maintain homeostasis.

CO4: To describe and compare the process and organization of signal transduction pathways of steroid hormones.

CO5: Elucidating the structure, and organization of hormone receptor and their regulation

CO6: Interpret the mechanism of apoptosis and its clinical Significance.

Disorders of major endocrine glands (Tutorial)

CO1: Understanding the principles of different endocrinal glands disorders of Endocrine glands.

CO2: Describe and interpret the endocrinal gland-associated disorders.

CO3: Analyze the importance of different types of diagnosis methods to summarize the prevalence and importance of major endocrine gland disorders.

FOURTH SEMESTER

Molecular Biology - II
CO1: Provide detailed information about prokaryotic and eukaryotic gene expression.

CO2: Understand the positive and negative regulatory mechanisms involved in gene expression.

CO3: Detailed explanation of translational regulation of the genes in humans and special emphasis on quantification of the transcripts.

CO4: Enable students to think and apply methods of molecular biology in designing a new product which will aid them in pursuing professional careers.

Molecular Pharmacology

CO1: Understand the basic principles of clinical pharmacology including drug categories, and divisions of pharmacology.

CO2: Explore and appraise the principal steps in drug discovery. Evaluate the rationale for the complete development plan (pharmaceutical, pre-clinical and clinical) according to the proposed therapeutic indication.

CO3: Elucidate the clinical pharmacokinetics of drugs to examine the absorption, distribution, metabolism, and excretion of a drug under investigation.

CO4: Interpret the pharmacological effects and mechanism of drugs, also to evaluate adverse drug reactions and drug-drug interactions.

CO5: Application of molecular pharmacology and molecular modeling to drug design

CO6: Evaluate potential technologies of gene transfer, therapeutic strategies, efficiency and safety issues

Nanobiotechnology

CO1: Understand the basic concept, properties, and the synthesis of nanomaterials by various methods.

CO2: Utilize structure and function relationship for the application of biological materials in nanotechnology.

CO3: Acquire a theoretical understanding of the latest applications of nanotechnology in cancer diagnostics and therapy, tissue engineering, artificial cells and organ printing.

CO4: Describe the applications of nanotechnology in point-of-care diagnostics, nanopharmacology and nanotechnology.

Biotechnology

CO1: Illustrate the use of DNA modifying enzymes and restriction enzymes for manipulation and analysis of genomic sequences.
CO2: Conceptualize properties and applications of cloning and expression vectors
CO3: Understand the basic differences between genomic and cDNA libraries. Describe the steps of genetic hybridization technique
CO4: Recognize and outline the main steps, types of PCR (polymerase chain reaction) and its applications
CO5: Acquire knowledge of engineering strategies of gene delivery, gene replacement in plants
CO6: Explain the main steps in plant genetic engineering and their application
CO7: Critically assess ethical issues related to Human gene therapy, organisms, Food and drugs.

Forensic science

CO1: Demonstrate an understanding of scientific principles and techniques of forensic science.

CO2: Apply essentials of chemistry at the time of death and blood analysis.

CO3: Use of DNA techniques in forensic analysis.

CO4: Understand the use of identification by fingerprinting, fibers and firearms.

CO5: Detection and identification of narcotics and drugs.

CO6: Ability to differentiate between accidental and deliberate poisoning.

Biochemical Genetics

CO1: Examine and integrate central ideas underlying the evolutionary patterns and processes from the molecular to organism level.

CO2: Investigate the Mendelian and Non-Mendelian inheritance at the chromosomal level.

CO3: Employ the scientific method of pedigree analysis to solve problems of human hereditary disorders

CO4: Analyze and explain viral genetics, structure and organization of gene.

CO5: Demonstration of structural organization and linkage map of the bacterial chromosome, mechanism of recombination.

CO6: Describe human genetic components and inheritance.

CO7: Analyzing the quantitative traits of human, heritability, environment interaction and measurement.

CO8: Understanding the gene flow in the population and applying its principles to newer situations