

Syllabus for Entrance Test for Admission to M.Sc. Biochemistry, UDSC

Essential Molecules of Life - The foundations of biochemistry, Carbohydrates, Lipids, Amino acids, Nucleic acids, Vitamins.

Proteins and Enzymes – Introduction to peptides and proteins, Extraction of proteins for downstream processing, Separation techniques, Characterization of proteins, Covalent structure and 3D-structures of proteins, Protein folding and conformational diseases, Introduction to protein structure databases, Myoglobin and haemoglobin, Specialized proteins– antibodies, actin-myosin motors and membrane proteins. Fundamentals of enzymes, Features of enzyme catalysis, Enzyme kinetics, Bisubstrate reactions, Enzyme inhibition, Mechanism of action of enzymes, Regulation of enzyme activity, Involvement of coenzymes in enzyme catalysed reactions, Applications of enzymes. Relation to diseases, therapy and diagnosis.

Metabolism of Carbohydrates, Lipids, Amino Acids and Nucleotides - Basic design of metabolism, Glycolysis, Gluconeogenesis and pentose phosphate pathway, Glycogen metabolism, Citric acid cycle, Synthesis of carbohydrates, Fatty acid oxidation, Fatty acid synthesis, Biosynthesis of eicosanoids, cholesterol, steroids and isoprenoids, Biosynthesis of membrane lipids. Overview of amino acid metabolism, Catabolism of amino acids, Biosynthesis of amino acids, Precursor functions of amino acids, Biosynthesis of purine and pyrimidine nucleotides, Deoxyribonucleotides and synthesis of nucleotide triphosphate, Degradation of purine and pyrimidine nucleotides, Integration of metabolism. Metabolic disorders and diseases.

Cell Biology, Membrane Biology and Bioenergetics - Introduction to cell biology, Tools of cell biology, Structure of different cell organelles, Protein trafficking, Cytoskeletal proteins, Cell wall and extracellular matrix, Cell cycle, cell death and cell renewal. Introduction to biomembranes, Membrane structures, Membrane dynamics, Membrane transport, Vesicular transport and membrane fusion, Introduction to bioenergetics, Oxidative phosphorylation, Photophosphorylation, Features of membrane proteins.

Human Physiology and Hormones- Homeostasis and the organization of body fluid compartments, Cardiovascular physiology, Respiration, Renal physiology, Gastrointestinal and hepatic physiology, Musculoskeletal system, Reproductive physiology, Neurochemistry and neurophysiology. Introduction to endocrinology, Hormone mediated signaling, Hypothalamic and pituitary hormones, Thyroid hormone, Hormones regulating Ca^{2+} homeostasis, Pancreatic and GI tract hormones, Hormones of adrenals, Reproductive hormones, Growth factors.

Gene Organization, Replication, DNA Repair, Transcription and Gene expression - Structure of DNA, Genes and genomic organization, Replication of DNA, Recombination and transposition of DNA, Molecular basis of mutations, Various modes of DNA repair. Biosynthesis of RNA in prokaryotes, Biosynthesis of RNA in eukaryotes, RNA splicing, The genetic code, Biosynthesis of proteins, Protein targeting and degradation, Regulation of gene expression in prokaryotes, Regulation of gene expression in eukaryotes.

Concepts in Genetics - Introduction to model organisms and Mendelism, Applications of Mendel's principles & chromosomal basis of heredity, Extensions of Mendelism, Genetic definition of a gene, Genetics of bacteria and viruses, Linkage, crossing over and mapping techniques, Human pedigree analysis, The genetic control of development and sex determination, Organelle heredity and epigenetics, Chromosomal aberrations, Inheritance of complex traits & population genetics, Evolutionary genetics

Genetic Engineering and Biotechnology - Introduction to recombinant DNA technology, Cloning vectors for prokaryotes and eukaryotes, Joining of DNA fragments, Introduction of DNA into cells and selection for recombinants, Methods for clone identification, Polymerase chain reaction, DNA sequencing, Expression of cloned genes, Applications of genetic engineering in Biotechnology.

Immunology - Cells and organs of the immune system, Innate immunity and leukocyte extravasation, Immunogens and antigens, Antibody structure and function, Generation of receptor diversity, Biology of the B lymphocyte, Complement system, MHC complex and antigen presentation, Biology of the T lymphocyte, Cell mediated cytotoxic responses, Tolerance, autoimmunity and hypersensitivity, Transplantation immunology and vaccines. Antibodies in diagnostics and therapy.