# Syllabus for entrance examination - PhD in Biochemistry

**BIOANALYTICAL TECHNIQUES** – Visible and UV Fluorescence and Mass Spectrometry (MS), Partition, paper, thin layer, ion exchange, affinity, HPLC and FPLC, Preparative, differential, density gradient and ultra-centrifugation, Bright field, Fluorescence, Phase contrast, dark field, Confocal, and Electron Microscopy. Continuous, zonal and capillary electrophoresis, Electroporation, Rate of radioactive decay. Cerenkov radiation; Autoradiography; Radioimmunoassay. Weak acids and bases. Henderson Hasselbalch equation. Physiological buffers. Acidosis and alkalosis.

**BIOMOLECULES** Classification, structure, functions, Chemical properties, biological importance and important derivatives of Carbohydrates, Amino acids, Proteins, Lipids , Nucleic Acids and Hormones **,** Stereoisomerism, and optical isomerism. Blood group and Bacterial cell wall polysaccharides. Structure of peptide bond. structure organization in protein, Identification of fats and oils, rancidity, Structural organization, composition and form of DNA and RNA. DNA double helix. Functions and structure of nucleotides.

**IMMUNOLOGY** Organs and cells of the immune system, Structure, and classification of immunoglobulins, T and B lymphocytes. B and T-cell receptor; their types, maturation, activation and differentiation; Antibody diversity, Complement system, .MHC, Antigen processing and presentation. T cells and NK cell mediated lysis; Antibody dependent cell mediated and Macrophage mediated cytotoxicity. Cytokines and their functions. Immunological tolerance, Immunity to Infection, Vaccines, Hypersensitivity, Autoimmunity.

**ENZYMES AND VITAMINS-** Classification, Isolation, and purification of enzymes. Enzyme Substrate complex, active site, Michaelis-Menten equation. Different plots. Reversible and irreversible inhibition. Competitive, non-competitive, uncompetitive, mixed type inhibitions, Suicide inhibitor, Mechanism of action of coenzymes and metal ions. Enzyme regulation, Feedback inhibition and feed forward stimulation. Allosteric enzymes, Occurrence, isolation and properties of multienzyme complex: multiple forms of enzymes., Classification, Chemistry and role of vitamins.

**METABOLISM**- Oxidation-reduction reactions, redox potentials, High energy phosphate compounds. Glycolysis, fermentation, TCA cycle, HMP, Gluconeogenesis, glycogenesis, glycogenolysis, glyoxylate,,GABA, glucoronate and ED pathways, Cori cycle, anaplerotic reactions. Metabolism of disaccharides. Hormonal regulation of carbohydrate metabolism. General reactions of amino acid metabolism. Urea cycle. Biological nitrogen fixation. Hydrolysis of tri-acylglycerols, Fatty acid metabolism, Lipid biosynthesis, Metabolism of cholesterol. Biosynthesis and degradation of nucleotides. Biosynthesis & degradation of porphyrins, Integration of metabolic pathways. Energetics and regulations of metabolic cycle.

**CELL BIOLOGY**

Sub cellular fractionation: Structural organization and function of intracellular organelles (structure & function of cytoskeleton and its role in motility). Membrane structure and function: Mitosis and meiosis, their regulation, Cell cycle its regulation and control. Role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, Modes of cell signalling, steroid hormone receptors, G-protein coupled receptors; regulation of signalling pathways, c- AMP, cGMP, phospholipids and calcium ions.

**CLINICAL BIOCHEMISTRY**

Diabetes mellitus, glucose and galactose tolerance tests, renal threshold for glucose, glycogen storage diseases, pentosuria, galactosemia. Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and disease. Myocardial infarction and atherosclerosis. Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, histidinemia., Jaundice, Fatty liver, Atherosclerosis & rheumatic disorders Disorders of porphyrin and heme metabolism. Cancer, Cellular differentiation, carcinogens and cancer therapy. Role of diet & nutrition in prevention and treatment of disease

Enzymes in health and diseases, Use of isoenzymes in diagnosis. Biochemistry and clinical significance of clinically important enzymes - SGOT, SGPT, CPK, cholinesterase, LDH, amylase and, lipase. Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes,. GFR and its clinical importance, clearance tests (creatinine Inulin and urea clearance tests).