



Eligibility Test for Research Program in Biochemistry

**SYLLABUS**

1. BIOMOLECULES
2. METHODS IN BIOCHEMISTRY
3. ENZYMES
4. METABOLISM
5. CLINICAL BIOCHEMISTRY AND NUTRITION
6. IMMUNOLOGY
7. CELL BIOLOGY
8. MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY
9. APPLIED BIOCHEMISTRY
10. RESEARCH METHODOLOGY

**1. BIOMOLECULES:** Composition, structure, Properties and functions of carbohydrates, lipids, proteins and nucleic acids. Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds). Confirmation of nucleic acids (A, B and Z DNA),  $T_m$  and  $cot$  value. Stability of protein and nucleic acid structures. Principles of biophysical chemistry-  $pH$ , buffers and their importance in biological system.

**2. METHODS IN BIOCHEMISTRY:** Microscopic techniques. Visualization of cells. TEM, SEM, Fluorescence and confocal microscopes. Freeze-etch and freeze-fracture methods for EM. Centrifugation: Principle and applications -Analytical & preparative, Differential and density gradient centrifugation. Chromatography Techniques: Principle and applications of Paper, TLC, Column, gel permeation, Ion exchange, Affinity chromatography, Gas chromatography, HPLC and FPLC. Electrophoresis techniques: : Principle and applications of Paper, gel electrophoresis, Isoelectric focusing, Isotachopheresis, High voltage electrophoresis, Capillary and Preparative electrophoresis. Spectrometry: Principle and applications of Uv-Visible spectroscopy, Fluorescence, ORD and CD, ESR, AAS, dispersion IR, NMR, MS, MALDI-TOF, Q-TOF. Isotope Techniques: Mass and Radio isotopes, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, F; Purification methods: Methods for purification of Biomolecules- Proteins, carbohydrates, nucleic acids, lipids. Immunotechniques: Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flowcytometry and immunofluorescence microscopy, detection of molecules in living cells,

**3. ENZYMES:** Enzyme localization, isolation, purification and characterization of enzymes.. Enzyme kinetics, regulation, mechanism of enzyme catalysis, isozymes, multienzyme complex, allosteric enzymes, Immobilised enzymes, Applications of enzymes, Biosensors, Enzyme biomarkers.

**4. METABOLISM:** Basic concepts of metabolism; catabolism, anabolism. Metabolism of carbohydrates, lipids, amino acids and nucleotides and their disorders.

### 5. CLINICAL BIOCHEMISTRY AND NUTRITION

**Clinical biochemistry** -Blood: Composition, blood count, blood group studies, blood coagulation, plasma proteins, lipoproteins, disorders of hemoglobin. Kidney profile, liver profile and their disorders, gastrointestinal disorders.

**Nutrition:** - Nutrients- macro and micro, energy value of food, SDA and BMR of food, food additives, food adulteration, food toxicants, food spoilage and preservation method. Nutritional studies of carbohydrates, proteins, fats, vitamins and minerals- sources, structure, function and deficiency symptoms. RDA Water and electrolyte balance.

**6. IMMUNOLOGY :** Innate immunity, adaptive immunity, Humoral and cellular immunity. Active and passive immunity, antigens, antibodies, antigen-antibody reactions, antigenicity, immunogenicity. B and T cell epitopes. Monoclonal antibodies: production and applications of monoclonal antibodies. Transplantation: Histocompatibility complex in man, tissue haplotype analysis, MHC. Tissue and organ grafting. Graft rejection, immunosuppressive agents. Vaccines and their preparation. Immune deficiency disorders.

**7. CELL BIOLOGY:** Subcellular organelles: structure and functions, cell-division, cell-cycle and its regulation. Cell signaling : Hormones and their receptors, , signaling through G-protein receptors, signal transduction pathways, second messengers, regulation of signaling



pathways. Cellular communication- general principles, cell adhesion. Cancer: The cell cycle. Carcinogens. Oncogenes, tumor suppressor genes, virus-induced cancer, metastasis, apoptosis.

**8. MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY:** Structure and functions of DNA and RNA, their isolation and purification. Mechanism of DNA replication, transcription and translation in prokaryotes, and eukaryotes, post transcription and post-translational modifications, regulation of prokaryotic and eukaryotic gene expression. Mutations. DNA damage and repair mechanism. Recombinant DNA technology; DNA modifying enzymes. Isolation and restriction digestion of genes. PCR, RAPD, RFLP. cDNA library. Cloning vectors & Cloning hosts. Methods of cloning. Gene transfer in plants and mammalian cell. Transgenic animals and plants

**9. APPLIED BIOCHEMISTRY:** Development and scope of microbial biotechnology, Industrial microorganisms, properties of useful industrial microorganisms, primary and secondary metabolites and their pathways. Industrial fermentation: Solid state fermentation, surface, submerged and. Upstream and Downstream processes, Recovery and purification of products. Microbial production of amino acids, sep, antibiotics, organic acid, alcohols, bioconversions, microbial polysaccharides, microbial insecticides, biofertilizers and bioleaching. environmental microbiology: Environmental pollution, use of microbes in pollution. Waste management. Bioremediation of environmental pollutants-degradation of xenobiotics- hydrocarbons, pesticides and surfactants and their ecological considerations.

**10. BIOINFORMATICS AND RESEARCH METHODOLOGY:** Manuscript preparation. Internet search engines. Biological databases. Phylogenetics, genomics and proteomics. Review or literature, Presentation of data – graphical presentation, Line graph, Histogram, Pie charts. Biostatistics: Mean, Mode, Median, Standard Deviation, Standard Error, Regression analysis.

  
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