

**Department of Biochemistry
GITAM Institute of Science
GITAM UNIVERSITY**

Syllabus for M.Phil. & Ph.D. entrance examination

Biochemistry and Bioinformatics

PART - A

UNIT – 1:

Isolation, Purification and characterization of Proteins: Homogenization techniques, Precipitation of proteins – ammonium sulfate and alcohol, Centrifugation techniques - preparative and analytical; Chromatographic techniques - paper, ion exchange, gel permeation and affinity; Electrophoretic techniques – PAGE, SDS-PAGE and 2-D; Spectrophotometric techniques - UV-visible, NMR, XRD and MALDI-TOF; Radiolabelled techniques. Quantification of proteins – ELISA and Western blotting.

Unit 2:

Isolation and separation of nucleic acids: Gel electrophoresis. Estimation of nucleic acids. Blotting techniques – Southern and Northern. Polymerase Chain Reaction (PCR), DNA Finger printing - RFLP and RAPD. Transformation, conjugation and transduction. Gene transfer methods: artificial – electroporation, microinjection and calcium phosphate; biological – viral and agrobacterium mediated. DNA sequencing – Maxam Gilbert and Sanger's dideoxy methods. Cloning vectors – plasmid, phage, cosmid, BAC, YAC and PAC.

Unit 3:

Biological data and its types. Nucleotide and protein sequence databases. Protein structure databases. Pair-wise and multiple sequence alignment. Molecular phylogeny. Protein modeling. Computer aided drug designing (CADD) - structure and ligand based virtual screening, ADMET studies. Clinical trials.

Unit 4:

Mean, Mode, Median and Standard Deviation. Variance, Probability, T - test, Chi-square test, ANOVA, Regression analysis and Correlation coefficient.

Principles of experimental design, collection assembly, analysis and interpretation of experimental data. Data presentation – tabular, graphical and diagrammatic representation.

PART - B

- Unit 1:** Structure, properties, functions and metabolism of carbohydrates, amino acids, proteins, lipids and nucleic Acids Principles of bioenergetics - Entropy, Enthalpy, Free energy, High energy compounds, Electron Transport chain, Substrate level and oxidative phosphorylation. Properties and classification of enzymes, factors affecting enzyme activity, Enzyme inhibition.
- Unit 2:** Structure of prokaryotic and eukaryotic cells. Structure and functions of plasma membrane, mitochondria, chloroplast, golgi, ER and nucleus. Membrane channels and pumps. Transport mechanisms. Membrane receptors and second messenger systems in signal transduction. Cell cycle and its regulation. Stem cells – types and properties. Replication, Transcription, Translation in prokaryotes and eukaryotes.
- Unit 3:** Photosynthesis - C₃, C₄ and CAM plants. Nitrogen fixation. Phytohormones. Principles of tissue culture. Regeneration pathways of plant tissue culture. Isolation and culture of protoplasts. Types of animal cell and organ cultures. Principles of inheritance. Linkage and crossing over. Mutagens and types of mutations. Sex determination, sex linked inheritance.
- Unit4:** Physiological role and disorders of hypothalamic, adenohipophysial, neurohipophysial, thyroid, parathyroid, renal, pancreatic, adrenal and sex hormones.
- Innate and Adaptive immunity. Immune cells and organs of immune system. Antigens and Antibodies, Antigen presenting cells. MHC, Humoral and cell-mediated responses. Cytokines, Hypersensitivity and Auto immunity.

Model Questions

1. Which one of the following is not involving in ATP formation
 - a) Oxidative phosphorylation
 - b) Substrate level phosphorylation
 - c) Photophorylation
 - d) Protein phosphorylation
2. Wobble hypothesis was proposed by
 - a) Watson
 - b) *Crick*
 - c) Morgan
 - d) Khorana
3. Hormone produced by beta cells of islets of langerhans is -----
4. An example for primary lymphoid organ is -----
5. Bromo uracil is a base analog of -----