

UNIVERSITY OF KASHMIR, SRINAGAR

Entrance syllabus for Admission to PG Diploma in Bioinformatics program -2024

Note – The following syllabus prescribed for the entrance test is comprised of fifteen units. Each unit carries a weightage of four marks. Paper setters are required to set four multiple type questions with only one correct or most appropriate answer from each unit giving uniform representation to the whole syllabus.

Unit-I

Basic chemistry: Basic constituents of matter - elements, atoms, isotopes, atomic weights, atomic numbers. Solutions, solvent and solute. Molarity, molality, amount concepts. Structure and properties of Water, ion product of water. pH, pK and pI, Buffers, concentration units in biological solutions. Acid- base equilibrium, Dissociation and Association Constants, Solubility and Criteria for Solubility, Hydrophobicity and Hydrophilicity. Laws of Thermodynamics. Concept of heat of reaction, enthalpy, entropy and Free energy, Concept of Chemical bonding, Electron Displacements, Dipole- Dipole interactions, hydrogen bond, Vander-waal's forces, hydrophobic and hydrophilic interactions,

Unit-II

Basic Mathematics and Biostatistics: Linear equations, functions: slopes-intercepts, forms of two-variable linear equations. Introduction to polynomials, graphs of binomials and polynomials Sample, Population, Sampling techniques. Mean, Median, Mode and Standard Deviation. Frequency Distribution, Standard error of Mean (SEM), p-Value, Student t- Test (Paired and Unpaired), Chi square Test; Representation of Data (Histogram, Bar Chart, Pie chart, Frequency curve).

Unit-III

Basic Biochemistry: Classification, structure, physical and chemical properties of Carbohydrates, Lipids, Proteins, Vitamins and Nucleic acids.

Unit-IV

Enzyme and Drugs: General characteristics, nomenclature and classification of enzymes. Enzyme kinetics and enzyme activity. Types of enzyme inhibitions. Allosteric regulation of enzyme activity. Drug metabolism, Pharmacological screening and assays

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Unit-V

Cell structure and function: Prokaryotic and Eukaryotic cell - Structure and Function of: Plasma Membrane, Nucleus, Endoplasmic Reticulum, Mitochondria, Golgi Apparatus, Ribosomes, peroxisomes, Lysosomes, Chloroplast. Membrane proteins and types of membrane transport.

Unit-VI

Intermediary metabolism: Cellular metabolism of Carbohydrate, Lipids, Amino Acids and Nucleotide. Glycolysis, TCA cycle, Urea Cycle, Gluconeogenesis, Glyoxalate cycle and Pentose Phosphate Pathway, de-novo and salvage pathway of nucleotide synthesis. Electron transport chain (ETC) and Oxidative phosphorylation.

Unit-VII

Molecular Biology: Prokaryotic and Eukaryotic Replication, Transcription, Translation-Mechanism and their regulation. DNA repair systems – Direct Repair, Excision Repair, Mismatch repair and Recombination Repair. Post transcriptional and translational modifications.

Unit-VIII

Genomics, transcriptomics and Proteomics: Genome organization of prokaryotic and eukaryotes. Genome sequencing projects with reference to human genome project. Basics of transcriptomic studies. Proteomics: Aims, strategies for proteomics; proteomics technologies: 2D-PAGE, isoelectric focusing, mass spectrometry, MALDI-TOF, proteome databases.

Unit-IX

Recombinant DNA technology: Tools of Recombinant DNA Technology, Cloning Vectors: Plasmids, Bacteriophages, Cosmids, Phagemids, YACs, Restriction enzymes, Ligases, Phosphatases, T4 Polynucleotide kinase, DNA Pol I and Klenow fragment. Selection marker genes of bacterial and yeast vectors. Protein expression in heterologous systems

Unit-X

Immune-biology: Innate and adaptive immunity, Antigen and Super antigens. Structure and function of immunoglobulins, MHC, T-cells and B-cells, Inflammation, cytokines, organization

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and structure of lymphoid organs, mechanism of cell mediated and humoral immune response, complement system, Monoclonal antibodies.

Unit-XI

Biochemical Techniques: Electrophoresis, Chromatography, Centrifugation, Spectrophotometry, and Microscopy. Blotting techniques (Western, Southern and Northern). PCR. Immunotechniques- RIA, ELISA, Immunodiffusion, Immunoelectrophoresis.

Unit-XII

Animal cell science and technology: Animal cell culture- Primary and secondary cell line cultures, cancer cell lines, suspension and adherent monolayer culture, and basic techniques of cell culture. Bioreactors: design and types, bioprocess technology, immobilization of enzymes, industrial applications of enzymes

Unit-XIII

Basics of Bioinformatics: Computers in biology and medicine; Introduction to Unix and Linux systems and basic commands; Database concepts; Protein and nucleic acid databases; Identification of protein sequence from DNA sequence; searching of databases similar sequence; NCBI; publicly available tools; resources at EBI; resources on web; database mining tools.

Unit-XIV

Microbiology: Structure and organization of microbial cells. Bacterial cell wall structure and biosynthesis, structure and function of outer membrane flagella. Kinetics and growth of Microbial cell, Gene transfer in bacteria; Transformation, Transduction and Conjugation. Antimicrobial agents, Drug resistance. Structure & classification of Viruses. Life cycle of lambda phage.

Unit-XV

Animal physiology: Physiology of circulatory, digestive, respiratory, excretory, endocrine, nervous and muscular system with reference to humans.