34

101: CELL BIOLOGY

M.Sc-IInd sem M.Sc - Biotechnology IInd sem.

UNIT I

1. Cell Membrane: Physicochemical Properties; Molecular Organization – asymmetrical organization of lipids, proteins and carbohydrates; Biogenesis and Functions
2. Transport of Small Molecules Across Cell Membranes: Types and Mechanism
3. Active Transport by ATP-Powered Pumps Types: p-type, V-type, F-type ABC transporters.
4. Properties and mechanisms of transporters; Patch pump technique.

UNIT II

1. Structure, function and transport of proteins into mitochondria and chloroplast.
2. Transport of proteins and RNA into and of nucleus.
3. Transport of proteins into endoplasmic reticulum and Golgi bodies.
4. Transport by vesicle formation: Endocytosis and Exocytosis and olecular Mechanism of vesicular transport.

UNIT III

1. Ultra structure and function of lysosomes, peroxisomes and Vacuoles.
2. Cell motility and shape I: Structure and functions of microfilaments
3. Cell motility and shape II: Structure and functions of microtubules and intermediate filaments
4. Intracellular communication through cell junctions: Occluding junctions, anchoring junctions and communicating junctions

UNIT IV

1. Molecular mechanism of cell-cell adhesions: Ca^{++} dependent cell-cell adhesion
2. Molecular mechanism of cell-cell adhesion: Ca^{++} independent cell-cell adhesion
3. Extra-cellular matrix of animals: organization and functions
4. Extra-cellular matrix receptors on animal cells: integrins

UNIT V

1. Cell Signaling: Signaling via G-Protein linked cell surface receptors, MAP kinase pathways and tyrosine kinase pathway: Initiation, interaction and regulation.
2. Eukaryotic cell division cycle: Different phases and molecular events
3. Control of cell division cycle: In yeast and mammalian cells
4. Apoptosis: Phases and significance, Morphological and biochemical changes associated with apoptotic cells, Apoptotic pathways and regulators

Sharma

102. BIOMOLECULES & METABOLISM

UNIT I

1. Carbohydrates: Structure, classification, properties, chemical reactions, stereoisomerism and functions.
2. Home and hereo polysaccharides, animal, plant and microbe specific polysaccharides, bacterial cell wall, carbohydrate derivatives: peptidoglycans, glycolipids, sialic acid.
3. Lipids; Classification, structure, properties and functions of fatty acids, triacylglycerols, phospholoipids, wax, sterols, terpenes, prostaglandins.
4. Lipids with specific biological functions, lipoproteins and biological membrane, micelles and liposomes.

UNIT II

1. Amino acids: Structure, classification, properties and functions, peptides and polypeptides.
2. Proteins: Properties, primary, secondary, tertiary and quaternary structure.
3. Vitamins and cofactors: structure, distribution, interaction and biological properties.
4. Nucleic acids: DNA: Structure, conformation, properties of purines nad pyrimidine bases, nucleosides and nucleotides; RNA: Structure, types and functions of mRNA, tRNA and rRNA.

UNIT III

1. First and second laws of thermodynamics & concept of free energy.
2. High energy phosphor compounds, ATP cycle, structural basis of free energy change during hydrolysis of ATP.
3. Carbohydrate metabolism: Basic concepts of glycolysis, glycogenesis, gluconeogenesis pathway and regulation.
4. Krebs cycle:, pentose phosphate pathway, glyoxalate pathway, glycogenolysis pathway and regulation, associated Intracellular communication through cell junctions: Occluding junctions, anchoring junctions and communicating junctions

UNIT IV

1. Electron transport and oxidative phosphorylation : electron carriers, complexes I to IV, chemiosmotic theory, substrate level phosphorylation
2. Plant phenolics, alkaloids: classification and functions. Plant hormones: structure and biological functions.
3. Lipid metabolism: Biosynthesis and degradation of odd carbon and even carbon
4. Saturated and unsaturated fatty acids, formation and of ketone bodies, regulation of Lipid metabolism, associated inborn errors.

UNIT V

1. Overview of amino acid metabolism: biosynthetic families of amino acids, breakdown of amino acids into six (to check) common intermediates.
2. Regulation of amino acid metabolism (Steps for the biosynthesis and breakdown of amino acids are not required) , associated inborn errors.
3. Nucleic acid metabolism: biosynthesis and breakdown of purine, pyrimidines, nucleotides by *de novo* and salvage pathways,
5. Regulation of metabolism, associated inborn errors.

103. MICROBIOLOGY

UNIT I

1. Classification of Microorganisms: Bacterial & Fungal Classification.
2. Morphology and fine structure of eubacteria, archeobacterial cell wall and fungal cell wall.
3. Preparation of culture media, pure culture techniques and microbial staining.
4. Cyanobacteria : General account and their economic importance

UNIT II

1. Sterilization: Physical and chemical methods.
2. Microbial growth: Bacterial growth curve, Mathematical expression, measurement of growth and factors affecting growth.
3. Microbial Nutrition: Nutritional classification of Microorganisms, Different carbon and nitrogen sources, mode of nutrition, transport of nutrition across the bacterial membrane.
4. Oxygen toxicity: Study of catalase, peroxidase, superoxidase dismutase, mechanism of oxygen toxicity/ Taxonomic classification of microbes using molecular markers- 16 rRNA typing.

UNIT III

1. Infection and disease, types of infection, Mechanism of pathogenesis of bacterial and viral disease.
2. *Staphylococccal* and *Clostridial* food Poisoning, Bacterial Diseases: Salmonellosis and Shigellosis.
3. Fungal Diseases: Histoplasmosis, Aspergillosis and Candidasis.
4. Viral diseases: Chicken Pox, Hepatitis B and Poliomyelitis.

UNIT IV

1. Virus organization, Types, Isolation, cultivation, identification and viral replication.
2. Structure and morphology of bacteriophages, lytic and lysogenic cycle.
3. Life cycle of DNA viruses: SV 40, RNA viruses: Retroviruses.
4. Plant viruses: TMV, Gemini, CMV, Human Viruses: Influenza (SARS), Herpes Simples virus, Rubella.

UNIT V

1. Micoplasma and diseases caused by them.
2. Bacterial Recombination: Transformation, conjugation, transduction, Plasmids and Transposes.
3. Chemotherapeutic agents: Classification of Antibiotics, Broad and narrow spectrum antibiotics; Antibiotics from prokaryotes.
4. Anti-fungal and antiviral antibiotics, mode of action of antibiotics and mechanism of drug resistance, origin of drug resistance.

104. BIOINSTRUMENTATION

UNIT I

1. Centrifugation: Principle, types and applications; sedimentation coefficient and factor affecting centrifugation
2. Photometry: Principle, instrumentation and application of UV-visible spectrophotometry
3. Infrared (IR) spectroscopy and its applications
4. Fluorescence spectroscopy: Principle, instrumentation and applications

UNIT II

1. Atomic absorption spectroscopy: Principle, instrumentation and application
2. Chromatography: Principle and applications of -Paper, thin layer and column chromatography
3. HPLC, Gas chromatography, Gel filtration and Ion exchange chromatography
4. Electrophoresis: Principle, types and applications; 2-D gel electrophoresis-Principle and its application

UNIT III

1. Electron spin resonance (ESR) spectroscopy
2. Nuclear Magnetic resonance: Principle, Instrumentation and applications
3. Circular dichrorism spectroscopy (CD): Principle, Instrumentation and applications:
4. X-ray crystallography: Principle, instrumentation and applications

UNIT IV

1. Mass spectrometry: Principle and components of mass spectrometer
2. Mass analyzers: Magnetic sector, Time of flight (TOF), Quadruople, advantages and disadvantages; LC-MS
3. Surface plasma resonance methods and its applications.
4. Flow cytometry: Principle, instrumentation and application

UNIT V

1. Microtomy: Types, Principal and applications.
2. Microscopy: Basic Principle and components of microscope, phase contrast and fluorescent microscopes
3. Electron microscopes: TEM and SEM- Principle and applications
4. Radioactivity: Principle, detection and measurement of isotopes: Autoradiography, types of radio isotopes used in biology and their application in biological science