

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA

DEPARTMENT OF BIOTECHNOLOGY

I B.Sc BIOTECHNOLOGY – I SEMESTER

PAPER – 1 - INTRODUCTION TO CELL BIOLOGY AND GENETICS

Theory

Credits: 3

3 hrs/week

I.LEARNING OUTCOMES

On successful completion of the course, the students will be able to

- Identify and describe the structure of different types of cells and their components.
- Explain the functions of cell organelles and mechanisms of cell transport.
- Apply Mendelian principles and recognize deviations in inheritance patterns.
- Analyze causes of mutations and describe DNA repair mechanisms.
- Compare normal and cancer cells, and explain the regulation of cell cycle and apoptosis.

II.Syllabus

Unit I

1.1 Cell as a basic unit of living organism; Cell wall Structure, chemical composition and function. Glycocalyx.

1.2 Structure and Function of Cell membranes;

1.3 Brief description of viral,bacterial, fungal, plant and animal cells.

Unit II

2.1 Sub-cellular organization of eukaryotic cell: Nucleus, nuclear envelope, transport across nuclear membrane; Nucleolus; cytosol, endoplasmic reticulum, chloroplast, mitochondria, vacuoles, ribosomes, peroxisomes, lysosome and golgi complex

2.2 Cell Transport: Active and Passive transport, phagocytosis, pinocytosis, exocytosis.

2.3 Chromosomes: Morphology, Structural Organization; Specialized chromosomes- Salivary gland & lamp brush chromosomes.

Unit III

3.1 Mendel Experiments, Mendel Laws and Deviations: Incomplete Dominance and Codominance; Concept of multiple alleles

3.2 Structure of prokaryotic and Eukaryotic chromosomes.

3.3 Eukaryotic chromosome organization, histone proteins.

Unit IV

4.1 Mutagenesis - Spontaneous and induced (Chemical and physical) mutations

4.2 Mutations- point mutations, frameshift mutations; Factors affecting DNA damage

4.3 Repair Mechanisms – Light induced repair, Excision repair and mismatch repair and SOS repair.

Unit V

5.1 Phases of the eukaryotic cell cycle - Mitosis and Meiosis;

5.2 Regulation of cell cycle check points. Basics of Cancer Development (Concept of Angiogenesis and Metastasis) and Cancer causative agents.

5.3 Proto- oncogenes, oncogenes. Differences between cancer cell and normal cell.

Programmed Cell Death. Introduction to cell signaling.

I B.Sc BIOTECHNOLOGY – I SEMESTER

PAPER – 1 - INTRODUCTION TO CELL BIOLOGY AND GENETICS

Practical

Credits: 1

2 hrs/week

List of Practical: -

1. Principle and utilization of microscope
2. Preparation of blood smear and observation of cells
3. Study of divisional stages in mitosis
4. Study of divisional stages in meiosis
5. Observation of differences between stained bacterial cells and cells in onion peels
6. Observation of permanent slides of bacterial, fungal, plant and animal cells
7. Problem solving in genetics
8. Human Karyotype analysis
9. Simple Mendelian traits in humans and pedigree analysis

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I B.Sc BIOTECHNOLOGY – I SEMESTER

PAPER – 2 - BIOLOGICAL CHEMISTRY

Theory

Credits: 3

3 hrs/week

I.LEARNING OUTCOMES

On successful completion of the course, the students will be able to

- Describe the chemical structure and structural variations of nucleic acids.
- Classify and explain the structures and functions of carbohydrates, lipids, and porphyrins.
- Explain the properties and structural organization of proteins using the Ramachandran plot.
- Analyze enzyme kinetics, substrate specificity, and different types of enzyme inhibition.
- Understand the principles of bioenergetics and summarize major energy-yielding metabolic pathways.

II.Syllabus

Unit I

Nucleic Acids

- 1.1 Chemical structure and base composition of nucleic acids (DNA and RNA). Chargaff's rules.
- 1.2 Watson Crick Model (B-DNA), deviations from Watson-Crick model. Alternative forms of DNA (A-DNA and Z-DNA).
- 1.3 Forces stabilizing nucleic acid structures, (hydrogen bonds and hydrophobic associations).

Unit II

Carbohydrates

- 2.1 Definition, classification, nomenclature of carbohydrates, structures of monosaccharides, disaccharides and polysaccharides.
- 2.2 Concept and examples of heteropolysaccharides.

Lipid:

2.3 Structure of saturated and unsaturated fatty acids, triglycerides, phospholipids, Chemistry of Porphyrines, Heme and Chlorophylls.

Unit III

Amino acids and Proteins:

3.1 Structure of amino acids occurring in proteins, classification of amino acids (pH based, polarity based and nutrition based) physico-chemical properties of amino acids.

3.2 Primary, Secondary, Tertiary & Quaternary structure of proteins.

3.3 Ramachandran Plot.

Unit IV

Enzymes:

4.1 Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc. Classification and nomenclature of enzymes. Substrate Specificity (bond specificity, group specificity, absolute specificity, stereospecificity), lock and key and induced fit models.

4.2 Enzyme kinetics: Michaelis-Menten equation, effect of substrate concentration, effect of enzyme concentration, effect of pH and temperature, temperature.

4.3 Enzyme inhibition (reversible inhibition types – competitive, uncompetitive and non-competitive), brief idea of irreversible inhibition.

Unit V

Bioenergetics:

5.1 Concept of free energy, Entropy, Enthalpy & Redox Potential. Concept of high energy bonds (structure of ATP).

5.2 Glycolysis, Krebs's cycle, Gluconeogenesis: Bypass reactions

5.3 Electron transport chain, Oxidative phosphorylation.

I B.Sc BIOTECHNOLOGY – I SEMESTER

PAPER – 2 - BIOLOGICAL CHEMISTRY

Practical

Credits: 1

2 hrs/week

List of Practical: -

1. Introduction to basic instruments (Principle standard operation procedure)
demonstration and record
2. Calculation of molarity, normality, and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates
5. Quantitative estimation of protein - Lowery method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Assay of protease activity
9. Preparation of starch from potato and its hydrolyzation by salivary amylase.