

CA S 465: CHEMISTRY OF BIOMOLECULES

Course Outcomes

- Enable the students to learn about cell structures, structure and functions of lipids and lipoproteins.
- To understand the importance and functions of enzymes and coenzymes in biological systems.
- It helps in understanding metabolic pathways of cholesterol, bile acids, and prostaglandins.
- Mechanism of reactions catalyzed by the above coenzymes.

UNIT-I

[12 Hours]

Cell Structure and Functions: Structure of prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of animal and plant cells. Overview of metabolic processes-Catabolism and anabolism. ATP- the biological energy currency. Origin of life-Unique properties of carbon, chemical evolution and rise of living systems.

Lipids: Fatty acids, essential fatty acids, structure and function of triacylglycerides, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins.

Lipoproteins: composition and function, role in atherosclerosis, properties of lipid aggregates, micelles, bilayers, liposomes and their biological functions. Biological membranes- Fluid mosaic model of membrane structure. Lipid metabolism (β -oxidation of fatty acids).

UNIT-II

[12 Hours]

Enzymes: Introduction, Classification, Enzyme substrate complex formation models: Lock and Key model, Host-Guest and Induced-Fit model. Factors affecting enzyme activity (pH, temperature), enzyme inhibition (reversible and irreversible) and immobilised enzymes. Examples of some typical enzyme mechanisms for Triose phosphate isomerase, α -Carboxy peptidase-A and Ribonuclease. Enzymatic synthesis of α -amino acids and peptides. Transformations of lipases and esterases. Kinetic resolutions of carboxylic acids, esters and alcohols-Trans- esterification. Enzymatic synthesis of α -amino acids and peptides. Transformations of lipases and esterases.

UNIT-III

[12 Hours]

Coenzymes: Introduction, Co-factors-co-substrates-prosthetic groups. Classification-Vitamin derived coenzymes and metabolite coenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate (TPP), pyridoxal phosphate (PLP), oxidized and reduced forms of nicotinamide adenosine dinucleotide / their phosphates (NAD, NADH, NADP⁺, NADPH), Flavin adenine nucleotide (FAD, FADH₂), Flavin mononucleotide (FMN, FMNH₂) and tetrahydrofolate. Adenosine triphosphate (ATP) and adenosine diphosphate (ADP). Mechanism of reactions catalyzed by the above coenzymes.

References

1. Lehninger Principles of Biochemistry, 7th edn., D. L. Nelson and M. M. Cox, Worth Publishers (2000).
2. Biochemistry, L. Stryer, W. H. Freeman and Company (1975).
3. Biochemistry, J. D. Rawn, Neil Patterson Publishers (1989).
4. Biochemistry, 4th edn., Voet Donald and Voet Judith G., John Wiley and Sons (2010).
5. Outlines of Biochemistry, 5th edn., E. E. Conn, P. K. Stumpf. G. Bruening and R. H. Doi, John Wiley & Sons (2006).
6. Enzyme structure and mechanism, F. Alam, W. H. Freeman and Company (1977).
7. Principles of Biochemistry, L. Moran, R. Horton, G. Scrimgeour and M. Perry, Pearson Education (2013).
8. Bioorganic Chemistry-A chemical approach to enzyme action, Herman Dugas and Christopher Penney, Springer (1989).

