SEMESTER – VIII

Course Title: Biochemistry

Credit: 4 (L-4, T-0, P-0)

Course code:

Contact Hrs/Week: 4 Hrs

Course Outcomes

Understanding these fundamental structures and molecular interactions is essential for comprehending the complexity of living cells and the myriad processes that occur within them.

Course Learning Outcomes (CLO): The students will be able to:

1. Proficiently analyze the structural features and functional properties of biomolecules, encompassing proteins, carbohydrates, lipids, and nucleic acids.
2. Effectively apply principles of biochemistry to elucidate the behavior of biomolecules in biological environments.
3. Demonstrate competence in integrating knowledge of biochemical pathways and molecular interactions to explain the physiological roles and pathological implications of biomolecules in living systems.

Unit I

Chemical composition of life, Basic concepts of chemistry, Water and its physicochemical properties, Ionization of water, pH, buffers, acids and bases, Principles of chemical bonding, Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interactions); Basic principles of Bioenergetics, equilibrium and concept of free energy, Entropy and Enthalpy.

Unit II

Classification, properties and functions of mono, di, and polysaccharides with special reference to glycogen, amylase and cellulose, glycosylation of other biomolecules. Lipids: Classification, properties and functions of important storage and membrane lipids, lipoproteins, Phospholipids, glycolipids, prostaglandins and cholesterol.

Unit III

Structure, classification, chemical properties of amino acids. Protein structure; primary and higher order structure, Ramachandran plot, Protein folding. Nucleic acids: Structure and functions, different forms of DNA and RNA. Techniques of Protein and Nucleic Acid Purification.

Unit IV

Introduction to Enzyme, Classification and Nomenclature, Enzyme kinetics, Michaelis Menten Kinetics, Lineweaver-Burk equation, Factors affecting enzyme activity, Enzyme inhibition, Coenzyme and Cofactors.

Unit V

A broad outline of metabolic pathways; Metabolic regulation and control of glycolysis, gluconeogenesis, Tri carboxylic acid (TCA) Cycle, glyoxalate and pentose phosphate pathways, metabolism of amino acids and their regulation, Nucleic acids biosynthesis de-novo and salvage pathways, Associated metabolic disorders (Diabetes, Fatty liver disease, Lesch-Nyhan syndrome & Gout), Ketone bodies.

Suggested Readings:

1. Lehninger, A. L. (2012). Principles of Biochemistry (6th ed.). New York, NY: Worth.
2. Voet, D. & Voet, J.G. (2016). Biochemistry (5th ed.). Hoboken, NJ: J.Wiley& Sons.
3. Stryer, L. (2015). Biochemistry. (8th ed.) New York: Freeman.
4. Dobson, C. M. (2003). Protein Folding and Misfolding. Nature, 426(6968), 884-890. doi:10.1038/nature02261.
5. Richards, F. M. (1991). The Protein Folding Problem. Scientific American, 264(1), 54-63. doi:10.1038/scientificamerican0191-54.

Course Title: Biochemistry Lab. **Credit:** 2 (L-0, T-0, P-4)

Course code: **Contact Hrs/Week:** 4 Hrs

Lab component

1. Preparing various stock solutions/buffer and working solutions that will be needed for the course.
2. To prepare an Acetic-Na Acetate Buffer and validate the Henderson-Hasselbach equation.
3. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-Vis Spectrophotometer and validating the Beer- Lambert's Law.
4. Titration of Amino Acids and separation of aliphatic, aromatic and polar amino acids by thin layer chromatography.
5. Enzyme assay to evaluate Kinetic Parameters: Km, Vmax and Kcat.