Course Code	Course Name	Credits
26BY503	PLANT BIOCHEMISTRY AND BIOPHYSICS	04

Course Objectives

- To learn about the classification, chemical properties as well as physical properties of carbohydrates, lipids, amino acids, nucleic acids and proteins in detail.
- The course will aid the students in understanding other accessory molecules like vitamins and photosynthetic pigments.
- To understand the concept of enzyme kinetics.
- Gain knowledge on the principles of biophysical chemistry & Bioenergetics.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Learn about the structure and function of major biomolecules (carbohydrates, proteins, lipids, nucleic acids).
- Explain enzyme action, kinetics, and metabolic pathways such as photosynthesis and respiration.
- Apply basic biophysical principles with biology.
- Engage to a wide range of topics that combine biology, physics and chemistry.

Unit 1 - Carbohydrates and Plant Biomolecules (12 Hrs.)

Classification, structure, and properties of carbohydrates. Monosaccharides, disaccharides, oligosaccharides. Polysaccharides: starch, cellulose, hemicellulose, pectin, inulin. Glycoproteins and proteoglycans. Biological role of carbohydrates in plants. Plant cell wall components and functions.

Unit 2 – Amino Acids, Proteins and Protein Chemistry (12 Hrs.)

Classification and properties of amino acids. Peptide bond and protein architecture- Primary, secondary, tertiary, quaternary structure. Ramachandran plot and conformational analysis- Motifs, domains, folds, chaperones. Hemoglobin as model protein.

Unit 3 - Lipids and Nucleic acid (12 Hrs.)

Fatty acids- structure, nomenclature, properties. Types of Lipids-Triacylglycerols, phospholipids, sphingolipids. Steroids, terpenoids, eicosanoids. Membrane lipids and lipid rafts. Structure of DNA and RNA. Components and polymerization of nucleotides. Biosynthesis of purines and pyrimidines.

Unit 4 – Enzymology and vitamins (12 Hrs.)

Classification and nomenclature of enzymes. Enzyme catalysis and active site theories. Michaelis–Menten kinetics. Lineweaver–Burk, inhibition kinetics. Competitive, noncompetitive, uncompetitive inhibition. Allosteric enzymes and cooperativity. Isozymes and ribozymes. Water-soluble and fat-soluble vitamins. Coenzymes and prosthetic groups.

Unit 5 - Biophysics (12 Hrs.)

Scope and importance of biophysics in plant sciences. Laws of thermodynamics. Free energy, entropy, and enthalpy. Energy transduction in biological systems. Nature of light and electromagnetic spectrum. Absorption spectrum and pigments- Chlorophyll, carotenoids, flavonoids. Fluorescence, phosphorescence, bioluminescence. Principles of spectroscopy, centrifugation, electrophoresis, chromatography.

Reference Books:

1. Narayanan, P. (2000). *Essentials of biophysics*. New Age International Publishers.
2. Stryer, L. (2005). *Biochemistry*. W. H. Freeman & Co.
3. Jain, J. L., Jain, S., & Jain, N. (2008). *Fundamentals of biochemistry*. S. Chand & Company Ltd.
4. Budhiraja, R. P. (n.d.). *Separation chemistry*. New Age International (P) Ltd.
5. Upadhyay, A., Upadhyay, K., & Nath, N. (n.d.). *Biophysical chemistry*. Himalaya Publishing House.
6. Arora, M. (n.d.). *Biophysics*. Himalaya Publishing House.
7. Roy, R. N. (n.d.). *A textbook of biophysics*. New Central Book Agency Pvt. Ltd.
8. Nelson, D. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman / Macmillan Learning.
9. Berg, J. M., Tymoczko, J. L., Gatto, G. J., & Stryer, L. (2023). *Biochemistry* (10th ed.). W. H. Freeman.