



CLUSTER UNIVERSITY, SRINAGAR

SYLLABUS (FYUP UNDER NEP 2022)

Offered by Department of Chemistry

Semester 6th (Major Course)

Title: Biological Chemistry

Course Code: UGCHM22J601

Credits: 4 (Theory: 3, Practical: 1)

Contact Hrs: 75 (Theory: 45, Practical: 30)

Max. Marks 100

Theory External: 60; Min Marks: 24

Theory Internal (Continuous Assessment): 15 Marks, Min Marks: 06

Practical Experimental Basis = 15, Min. Marks: 06

Practical Experimental (Continuous assessment) = 10, Min. Marks: 04

Course Objectives:

- Describe the structure and function of the major classes of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids.
- Explain the chemical properties that enable biomolecules to perform their biological functions.
- Understand the molecular basis of genetic information storage, replication, transcription, and translation.

Course outcomes:

On completion of the course, the student should be able to:

- Understand the importance of metal ions in biology
- Identify the structures and functions of carbohydrates, lipids, proteins, and nucleic acids.
- Have the knowledge of various enzymes and their activities
- Understand the physical aspect of the important biological processes like transport across membranes.

Unit –I: Bio-Inorganic Chemistry

(15 Hours)

Classification of elements in human system. Concept of essentiality; biodistribution and biochemical role of essential trace elements: Fe, Zn, Cu, P, F and I. Effects of deficiency of essential trace elements in biological systems and its treatment. Role of alkali and alkaline earth metal ions in biological systems. Lithium and the mental health. Chlorophyll: Role of magnesium in photosynthesis.

Elementary idea about Enzyme, Apoenzyme, Coenzyme, Prosthetic group and Metalloenzymes. Toxicity of heavy metals: Hg, Pb and As and its treatment.

Unit-II: Bio-Organic Chemistry

(15 Hours)

Carbohydrates: Introduction, Classification, Reactions of monosaccharide's (glucose): Epimerization, Oxidation (using Fehling's solution and Tollen's reagent), Reduction reactions (using NaBH₄). Formation of hemiacetal/acetals. Structural features and utility of maltose, galactose, lactose and sucrose.

Polysaccharides: Structural features of cellulose and starch.

Amino-Acids: Introduction, classification, acid –base properties, isoelectric point.

Proteins: Primary, secondary, tertiary and quaternary structure. Denaturation of proteins. Glycoproteins: Blood types A, B and O.

Unit-III: Biophysical Chemistry

(15 Hours)

Thermodynamics of living systems, Biochemists standard state, standard free energy changes in biochemical reactions, ATP as energy currency of cell.

Biological membranes: Ion transport through cell membrane, Mechanism of Membrane Transport (active and passive transport).

Membrane potential, Classical theory of membrane potentials; Nernst Equation, Nerve conduction: Action potential, factors affecting speed of action potential propagation.

Tutorial (1 credit: 30 Hours)

1. Understanding stereochemistry and identification of active sites of proteins using various biological 3D Modeling softwares like Jmol, BIOVIA Draw, ChemDraw etc.
2. Animations showing how amino acids form proteins and protein folding.
3. Animations showing Osazone formation and identification of sugars based on Osazone formation.
4. Animations (in video form) showing how glucose interacts in our body.

Books Recommended:

1. Organic Chemistry 8 th Ed. - F. A. Carey and Robert M. Giuliano (McGraw Hill-2012).
2. Organic Chemistry 5 th Ed, R.J. Fessenden, J.S. Fessenden. (Brooks/Cole-1993).
3. Organic Chemistry, A mechanistic Approach, Penny Chaloner (CRC Press-2015).
4. Organic Chemistry, Paula Y, Bruice (Pearson, New Age International Edition)
5. Advanced Organic Chemistry, 5 th Ed., F.A Carey & R.J Sundberg (Springer-2007).
6. Organic Chemistry, 2 nd Ed., Jonathan Clayden (OUP-2016).
7. Organic Chemistry, 11 th Ed., Solomons, T.W.G., (Wiley-2015).
8. Organic Chemistry, 7 th Ed. Morrison, Boyd and Bhattacharya. (Pearson-2013.)
9. Bioinorganic Chemistry- An introduction; Ochiai; Allyn and Bacon;1977.
10. Principles of Bioinorganic Chemistry; S. J. Lippard and J. M. Berg; University Science Books; 1994.
11. The Inorganic Chemistry of Biological Processes; IInd edn.; M. N. Hughes; John Wiley;1973.