

GENERIC ELECTIVES-14: MOLECULES OF LIFE

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Molecules of Life (GE-6)	4	2	0	2	Class XII Pass	----

Learning Objectives

- To deliver information about the chemistry of carbohydrates, proteins & enzymes and its relevance in the biological system using suitable examples.
- To place key emphasis on understanding the structural principles that govern reactivity/physical /biological properties of biomolecules as opposed to learning structural details.

Learning outcomes

By the end of the course, the students will be able to:

- Learn and demonstrate how the structure of biomolecules determines their chemical properties, reactivity and biological uses.
- Gain an insight into the mechanism of enzyme action and inhibition.
- Understand the basic principles of drug-receptor interaction and SAR.

Syllabus - Theory:

Unit 1: Carbohydrates

12 Hours

Classification of carbohydrates, reducing and non-reducing sugars, biological functions, general properties and reactions of glucose and fructose, their open chain structure, epimers, mutarotation and anomers, reactions of monosaccharides, determination of configuration of glucose (Fischer proof), cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosaccharides: structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Unit 2: Amino Acids, Peptides and Proteins

10 Hours

Classification of amino acids and biological uses of amino Acids, peptides and proteins. Zwitterion structure, isoelectric point and correlation to acidity and basicity of amino acids. Determination of primary structure of peptides, determination of N-terminal amino acid (by

Edman method) and C– terminal amino acid (with carboxypeptidase enzyme). Synthesis of simple peptides (up to dipeptides) by N-protection (t-butyloxycarbonyl) & C-activating groups (only DCC) and Merrifield solid phase synthesis, Overview of primary, secondary, tertiary and quaternary structure of proteins, denaturation of proteins.

Unit 3: Enzymes and correlation with drug action

08 Hours

Classification of enzymes and their uses (mention Ribozymes). Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and non-competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure – activity relationships of drug molecules, binding role of –OH group, –NH₂ group, double bond and aromatic ring.

Practicals:

(60 Hours)

1. Estimation of glucose by Fehling's solution.
2. Determination of total sugar content by ferricyanide method (volumetric/colorimetric method).
3. Study of the titration curve of glycine.
4. Estimation of proteins by Lowry's method.
5. Study of the action of salivary amylase on starch under optimum conditions.
6. Qualitative tests for amino acids, proteins and carbohydrates.
7. Separation and identification of mixture of sugars by paper chromatography.

References:

Theory:

1. Finar, I. L. **Organic Chemistry** (Volume 1 & 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Morrison, R. N.; Boyd, R. N., Bhattacharjee, S.K. (2010), **Organic Chemistry**, 7th Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Berg, J. M.; Tymoczko, J. L.; Stryer, L. (2019), **Biochemistry**, 9th Ed., W. H. Freeman Co Ltd.

Practicals:

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. (2012), **Vogel's Textbook of Practical Organic Chemistry**, Pearson.
2. **Manual of Biochemistry Workshop**, 2012, Department of Chemistry, University of Delhi.

Teaching Learning Process:

- Chalk and black board method. Along with pedagogy of flipped classroom

- Certain topics like mechanism of enzyme action and enzyme inhibition can be taught through audio-visual aids.
- Students should be encouraged to participate actively in the classroom through regular presentations on curriculum-based topics, peer assessment, designing games based on specific topics etc.
- As the best way to learn something is to do it yourself, practicals are planned in such a way so as to reinforce the topics covered in theory.

Assessment Methods:

- Graded assignments
- Class tests and Quizzes
- Class seminars by students on course topics with a view to strengthening the content through width and depth
- Continuous evaluation for the practicals
- End semester university theory and practical examination.

Keywords: Carbohydrates, point, Amino acids, Enzymes, SAR, Drug Receptor Theory

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.