

ALLIED COURSE PAPER - II

MOLECULES OF LIFE

Marks: 150

It is the harmonious and synchronous progress of chemical reactions in body which leads to life. These chemical reactions involve certain molecules called biomolecules or molecules of life. These molecules constitute the source of energy in body, build the body, act as catalyst in many processes and also responsible for the transefer of characters to offsprings. In this paper one would get the information about the structures of these molecules and their role in life related processes. The basic types of molecules included are carbohydrates, proteins,enzymes, lipids and nucleic acids.

THEORY

Unit 1: Carbohydrates.

Classification of carbohydrates, reducing and non reducing sugars, General Properties of Glucose and Fructose ,their open chain structure. Epimers, mutarotation and anomers. 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

Classification of Amino Acids, Zwitter ion structure and Isoelectric point.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides ,determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis.

Unit 3: Enzymes and correlation with drug action

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,

Unit 4: Nucleic Acids

Components of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (**nomenclature**), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (**types of RNA**), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Unit 5: Lipids

Introduction to lipids, classification.

Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number.

Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Unit 6: Concept of Energy in Biosystems

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats.

Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change.

Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

Recommended Texts:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Pearson Education, VI Edition, 1992.
2. Finar, I. L. *Organic Chemistry (Volume 1)*, Pearson Education, VI Edition, 1973.
3. Finar, I. L. *Organic Chemistry (Volume 2)*, Pearson Education, VI Edition, 1973.
4. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry*, W. H. Freeman VII Edition, 2004.
5. Berg, J. M., Tymoczko, J. L. & Stryer, L. *Biochemistry*, W. H. Freeman, V Edition, 2002.

PRACTICAL

EXTRACTION, SEPARATION AND PURIFICATION OF SELECTED BIOMOLECULES & DRUGS

1. Separation of amino acids by paper chromatography
2. To determine the concentration of glycine solution by formylation method.
3. Study of titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. To determine the saponification value of an oil/fat.
7. To determine the iodine value of an oil/fat
8. Differentiate between a reducing/nonreducing sugar.
9. Extraction of DNA from onion/cauliflower

10. To synthesise aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC.

Recommended Texts:

1. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, ELBS.
2. Ahluwalia, V.K.; Dhingra, S. & Gulati, A. *College Practical Chemistry*, Universities Press, 2005.