I SEMESTER

BTH 401 BIOCHEMISTRY AND BIOPHYSICS Hours: 52

Course outcome

The student will learn about:

CO 1. chemical bonds, thermodynamic principles and their applications in biological systems, and importance of pH and buffers in the cells.

CO 2. diversity and function of major groups of biomolecules- carbohydrates, proteins, and lipids along with nucleic acids.

CO 3. catabolic and anabolic pathways of carbohydrates, amino acids, nucleic acids and lipids.

CO 4. diverse structures seen in proteins including its secondary, tertiary and quaternary structure.

UNIT I (13 hrs)

Chemical bonds and intramolecular interactions. Thermodynamic principles, free energy, enthalpy and entropy, chemical equilibrium, chemical reaction kinetics, redox processes. ATP as an energy currency in the cell and other high energy compounds. Standard free energy, coupled reaction. pH and buffer concept and calculations in buffer preparation. Carbohydrates: stereochemistry, general reactions, classification, polysaccharides: structure, function - relation (e.g. Starch and cellulose). Carbohydrate metabolism: Glycolysis, inter conversion of various monosaccharides, pathway of citric acid cycle, anaplerotic reaction, gluconeogenesis and pentose phosphate pathway.

UNIT II (13 hrs)

Classification of amino acids, general reactions, titration curves. Amino acids - deamination, transamination, transdeamination, decarboxylation, urea cycle, ketogenic and glucogenic amino acids. Metabolism of aromatic amino acids, histidine, cysteine and serine. Peptide bonds, conformational properties of polypeptides: primary, secondary, tertiary and quaternary structures. Globular and fibrous proteins. Protein structure: α-keratin, silk fibroin, Myoglobin, collagen, hemoglobin. Protein folding: denaturation, effects of temperature and solvent on the thermodynamics of protein folding and unfolding equilibrium.

UNIT III (13 hrs)

Nucleic acid chemistry, bases, base-pairing rules, Watson-Crick model of DNA, Properties of DNA-denaturation, renaturation, melting temperature, hyperchromicity, different structural forms of DNA. Different types of RNAs, general chemical reactions of RNA and DNA. Nucleic acid metabolism: Biosynthesis - de novo and salvage pathways, catabolism of purines and pyrimidines.

UNIT IV (13 hrs)

Lipid classification, triacyl glycerol, phospholipids, sphingolipids, cholesterol and liposomes; prostaglandins, leukotrienes, thromboxanes, Plasma lipoproteins. Biosynthesis of fatty acids, cholesterol biosynthesis, ketone body formation, interconversion of phospholipids. Oxidation of fatty acids, α, β & ω types. Energetics of β oxidation. Biological functions of fat-soluble vitamins: A, D, E and K. Water soluble vitamins: coenzymes.

References

1) Biochemistry. Berg JM., Tymoczko JL. and Stryer L., Freeman & Co., New York, 2002