Department of Chemistry
St. Xavier's College, Kolkata
SEMESTER VI
BIOCHEMISTRY

(18-20 Lectures)

A) Structural aspects of Biomolecules (10 marks) 9 lectures

Proteins- Introduction and classification. Protein structure- primary, secondary, tertiary and quaternary structure(Forces that stabilizes structure of proteins: H-bonds, hydrophobic bond, electrostatic attraction, Vanderwaals interaction, dipole-dipole interaction.) Denaturation and renaturation of proteins. Behavior of proteins in solutions, salting- in and salting -out of proteins. Structure and biological function of fibrous proteins (keratins, collagen and elastin)

*(Globular proteins and structural aspects of carbohydrates are excluded as Chem (H) students study these in details in Bioinorganic Chemistry).

Nucleic acids- Nucleosides and nucleotides. Nature of genetic material. Composition of RNA and DNA, generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, complementary base- pairings, features of DNA double helix (Watson-Crick model). Denaturation and annealing of DNA, structure and role of different types of RNA. Size of DNA of prokaryotic and eukaryotic cells.

Lipids- Definition and classification. Fatty acids- properties of saturated and unsaturated fatty acids. Esters of fatty acids-formation and hydrolysis; Essential fatty acids. Triacyl glycerols. Reactions and characterization of fats – hydrolysis, saponification value, iodine number, rancidity of fats, Reichert- Meissel number. Biological significance of fats. Characterization of fats, Phospholipids, Micelle bilayer, liposomes, Glycolipids, steroids and sterols.

B) **Bioenergetics and Metabolism**: (2.5 **marks) 2 lectures**

Principles of Bioenergetics: Bioenergetics and Thermodynamics, Phosphoryl group transfers and ATP generation, Biological Oxidation and Reduction reaction.

C) **Carbohydrate metabolism: (5 marks) 5 lectures**

Intracellular metabolism of glucose - glycolysis, reaction and energetic of TCA cycle, (gluconeogenesis, glycogenesis, glycogenolysis, reactions and physiological significance of pentose phosphate pathway, regulation of glycolysis, TCA cycle, and glycogen metabolism).

D) **Oxidative phosphorylation and electron transport chain: (2.5 marks) 2 lectures**

Structure of mitochondria, sequence of electron carriers, ATP synthesis, inhibitors of ETC, basic concept of oxidative phosphorylation, inhibitors and uncouplers of oxidative phosphorylation, photophosphorylation.

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E) **Lipid metabolism: (2.5 marks)**
Metabolism (anabolism and catabolism) of triglyceride, Transport of fatty acid into mitochondria, Beta-oxidation of fatty acids, reactions and energetic of beta oxidation, biosynthesis of saturated and unsaturated fatty acids, metabolism of ketone bodies, biosynthesis of phospholipids and cholesterol.

F) **Amino acid metabolism: (5 marks)**
General reactions of amino acid metabolism (oxidative deamination, transamination, decarboxylation etc), glucogenic and ketogenic amino acids, urea cycle, biosynthesis and catabolism of amino acids (glycine, phenylalanine, glutamic acid), inborn errors of amino acid metabolism.

G) **Nucleotide metabolism: (2.5 marks)**
Biosynthesis and catabolism of purines and pyrimidines (Adenine and cytosine)

H) **Enzymes: (20 marks)**
Cofactors – Definition, examples of a) metal ions b) coenzymes c) prosthetic group Definition, examples of holoenzymes, Apoenzyme.
Classification of enzymes, IUPAC system, Name & examples of each class
Mechanism of enzyme activity—standard free energy change in a reaction-transition state, activation energy both in non-enzymatic and enzymatic reaction, reaction rate, rate constant, rate limiting step, rate equation, binding energy, specificity of enzymes geometric and stereo specificity with example, lock & key hypothesis, induced fit hypothesis, proximity and orientation effect, strain and distortion theory, enzyme catalysis-i) acid- base catalysis, ii)metal ion catalysis iii) covalent catalysis –Examples .

Enzymes kinetics- concept of steady state kinetics, initial rate, maximum velocity, Michaelis constant, Michaelis- Menten equation, graphical representation, Significance of KM & VMax ,double reciprocal plot, Kcat/K_M, enzyme catalyzed bi substrate reaction, sequential & ping pong reaction-(only example). transaminase & fructose bisphosphate aldolase

Quantitative assay of enzyme activity- Unit of enzyme activity, specific activity, molecular activity/ turnover number, molar activity, katal.

Factors on which enzyme catalyzed reaction depends- substrate concentration, enzyme concentration, pH, temperature, time, cofactors (role of NAD& NADP, FMN & FAD, TPP PALPO, FH4, HSCoA), inhibitors

Inhibition of enzyme catalyzed reaction- competitive, noncompetitive, uncompetitive, irreversible inhibition, example in each case.

Regulatory enzyme- allosteric enzyme, definition & example, allosteric modulators, feedback inhibition, kinetic properties of allosteric enzyme, K enzymes, M enzymes, sequential model & symmetry model, examples, regulation by covalent modification (like

phosphorylation), example, regulation by proteolytic cleavage of protein, zymogens, example

Isozymes-Definition and basis of difference, example-lactate dehydrogenase.

*** (E,F,G,H part can be included if restructured syllabus of 50 marks get accepted)