

Syllabus

M.Sc. (Chemistry) Programme

(SEMESTER – III)

Bio-Inorganic, Bio-Organic and Bio-Physical Chemistry
Programme Code- (MSCCH -21)
Course Code – (MSCCH -603)

Block I Bioinorganic Chemistry

Unit 1: Metal Storage and Transport

Ferritin, transferrin, and siderophores, Hemoglobin and myoglobin – Perutz mechanism models of oxygen carriers, photosynthesis PSI and PSII systems, nitrogen fixation.

Unit 2: Metalloenzymes

Zinc enzymes - carboxypeptidase and carbonic anhydrase, Iron enzymes - catalase, peroxidase and cytochrome P-450, copper enzymes - superoxide dismutase, Molybdenum oxotransferase enzymes-xanthine oxidase, Coenzyme vitamin B₁₂.

Unit 3: Metal-Nucleic Acid Interactions

Metal complex – nucleic acid interaction modes of binding to DNA, DNA cleavage, Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and chemotherapy with particular reference to anticancer drugs.

Block II: Bioorganic Chemistry

Unit 4 Introduction

Basic considerations, chemical background of biomolecules (protein, lipids, carbohydrates and nucleic acids). Proximity effects and molecular adaptation.

Unit 5 Enzyme & Mechanism of Enzyme action

Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed, mutagenesis. Enzyme kinetics, Michaelis-Menten and

Lineweaver-Burk plots, reversible and irreversible inhibition. Transition state theory, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

Unit 6 Kinds of Reactions catalysed by Enzymes

Nucleophilic displacement on phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in isomerization reactions, β -cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalysed carboxylation and decarboxylation.

Unit 7 Co-Enzyme Chemistry:

Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalysed by the above cofactors.

Unit 8 Biotechnological Applications of Enzymes:

Large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Block III Biophysical Chemistry

Unit 9 Bioenergetics:

Standard free energy change in Biological Reaction. Hydrolysis of ATP, Synthesis of ATP from ADP.

Unit 10 Biopolymer Interactions ,Thermodynamics of Biopolymer Solutions:

Forces involved in biopolymer interactions. Electrostatic charge and molecular expansion, hydrophobic forces, osmotic pressure, membrane equilibrium. Biopolymers and their Molecular Mass Size, shape and molecular mass of biopolymers, determination of molecular mass of biopolymers by various experimental techniques.