SEMESTER III

Paper XI

MCH-501: APPLICATION OF SPECTROSCOPY
(Inorganic Chemistry)

Unit I

Vibrational Spectroscopy
Symmetry and shapes of AB, AC, AB2, A2B, and AB3, mode of bonding of ambidentate ligands, nitrites, ethylenediamine and diethylenetriamine complexes, application of resonance Raman spectroscopy, particularly for the study of active sites of metalloproteins.

Unit II

Electronic Spin Resonance Spectroscopy
Hyperfine coupling, spin polarization for atomic and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having unpaired electrons) including biological systems and to inorganic free radicals.

Unit III

Nuclear Magnetic Resonance of Paramagnetic Substances in Solution
The concept and paramagnetic broadening, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nucleus with emphasis on 19F and 195Pt NMR.

Unit IV

Mössbauer Spectroscopy
Basic principles, stick and gamma-ray spectrometry, application of the technique in the studies of (i) bonding and structure of Fe-2 and Fe-3 compounds including those of intermediate spins, (ii) Fe-2 and Sn-1 compounds native of M-I; (iii) coordination number, isomer shift and (iv) detection of oxidation state and inequivalent MB atoms.

Unit V

Electronic Spectroscopy:
Electronic Spectral Studies for d5 systems in octahedral, tetrahedral and square planer complexes.

Book Suggested

Paper XII

MCH-502: PHOTOCHEMISTRY

Unit I

Photochemical Reactions
- Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy, stoichiometry.

Unit II

Determination of Reaction Mechanism
- Classification, rate constants and life times of reactive energy state determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions: photo dissociation, gas phase photolysis.

Unit III

Photochemistry of Alkene
- Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-structures.

Photochemistry of Aromatic Compounds
- Isomerisation, additions and s substitution.

Unit IV

Photochemistry of Carboxyl Compounds
- Intramolecular reactions of carboxyl compounds-saturated, cyclic and acyclic, e.g. unsaturated and a, b unsaturated compounds, cyclohexadienes. Intermolecular reactions, dehydrogenations and oxetane formation.

Unit V

Miscellaneous Photochemical Reactions
polyners, Photochemistry of vision

Books Suggested


Paper-XIII
MCH-503: BIOCHEMISTRY

Unit I

Metal Ions in Biological Systems
- Bic and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K⁺/Na⁺ pump.

Bioenergetics and ATP Cycle
- DNA polymerization, glucose storage, metal complexes in transmission of energy:
- chlorophyll, photosystem I and photosystem II in cleavage of water.

Transport and Storage of Oxygen
- Hem proteins and oxygen uptake structure and function of hemoglobin, myoglobin,
- hemeoxygen and hemerythrin, model synthetic complexes of iron, cobalt and copper.

Unit II

Electron Transfer in Biology
- Structure and function of metal of proteins in electron transport processes cytochrome's
- and non-sulphide proteins, synthetic models.

Nitrogen fixation
- Biological nitrogen fixation, and its mechanism, nitrogenase. Chemical nitrogen fixation.

Unit III

Enzymes
- Introduction and historical perspective, chemical and biological catalysis, remarkable
- properties of enzymes like catalytic power, specificity and regulation, nomenclature and
- classification, extinction 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-Menton and Lineweaver Burk plots, reversible and irreversible inhibition.

Mechanism of Enzyme Action
Unit IV

Co-Enzyme Chemistry
Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes.
Biophysical chemistry, chemiluminescence and analysis, molecular recognition, molecular geometry and crystalinity. Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrin-based enzyme models, clayrimers, ionophores, micelles synthetic enzymes.

Biotechnological Applications of Enzymes
Bioprocess production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry, brewing and cheese-making, starch from potato starch enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Unit V

Biological Cell and its Constituents
Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. RNA, DNA transition.

Biocatalysis
"Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

Biopolymer Interactions
Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves.

Cell Membrane and Transport of Ions

Book Suggested
Analysis of Water Pollution

Origin of water pollution-geographical, industrial, agricultural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates, and different forms of nitrogen. Heavy metal pollution-public health significance of cadmium, aluminium, copper, lead, zinc, manganese, mercury and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems.


Analysis of soil, Fuel, Body Fluids and Drugs

(a) Analysis of Soil: nitrogen, phosphorus, silica, lime, magnesia, ammonia, sulphur and alkali salts.

Chemical Chemistry

Composition of blood-collection and preservation of samples. Chemical analysis: serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulin, haemoglobin, acid and alkaline phosphates. Enzyme analysis: principles of radioimmunoassay (RIA) and applications. The blood gas analysis trace elements in the body.

Drug analysis: narcotics and dangerous drugs. Classification of drugs, screening by gas and high-performance chromatography and spectrophotometric measurements.

Books Suggested

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Books Suggested:
1. Modern Organomety Vol. 1, 2, 3, 4, 5 by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
2. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
3. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
4. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
5. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
6. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
7. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
8. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
9. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.
10. Modern Organometallic Chemistry by S.P. Saha and A.K. Ray,    
    Eastern Book Distributors, New Delhi.

Unit I
Stress, stress and activity relationship between chemical structure and biological activity
(Chemometric methods, receptor binding theory, molecular modeling, QSAR).

Unit II
Pharmacodynamics:
Drug action on enzymes, mechanism of drug action, enzyme inhibition.

Unit III
Antibiotics and antibiotics:
Antibiotics and their action, antibiotics and their action, antibiotics and their action.

Unit IV
Antituberculosis agents, antibiotics and their action, antibiotics and their action.
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Antimarialcytes: Chemotherapy of malaria, SARP, Chloroquine, Chlorogranimalum and Mefloquine.

Unit V
Non-steroidal Anti-inflammatory Drugs: Diclofenac, Sodium, Ibuprofen and Naproxen.
Antihistaminic and anti-inflammatory agents: Terfenadine, Cimicafine, Salbutamol and Brucetimidine dipropionate.

PRACTICAL
(Duration: 6-8 hrs in each branch)
Practical examination shall be conducted separately for each branch.

Inorganic Chemistry
Preparation: 12
Spectrophotometric Determinations: 12
Flame Photometric Determinations: 04
Vena Vos: 02

Preparation
Preparation of selected inorganic compounds and their study by IR, electronic spectra, and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines. Selection can be made from the following:

2. Atomic absorption analysis of Mg and Ca.
4. Sodium tetrahydroborate NaBH₄.
7. Cr₆ and YIn [CrO₄(CN)₂]₂⁻.
10. Preparation of [Co(phenanthroline)]₂(5,6 quinone).

Spectrophotometric Determinations
a. Manganese/Cadmium in steel sample.
b. Nickel by extractive spectrophotometric method.
c. Phosphorus/nitrite/phosphate.
Disconnection Approach
An introduction to syntheses and synthesis equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cycloaddition reactions, amine synthesis.

Unit II
One Group C-C Disconnections
Alcohols and carbonyl compounds, regioselectivity, allylic synthesis, use of acrylonitrile and alkyl nitro compounds in organic synthesis.

Two Group C-C Disconnections
Diels-Alder Reaction, 1,3-dipolar cycloaddition compounds, a-b unsaturated carbonyl compounds, control in carbonyl syntheses, 1,3-dipolar cycloaddition compounds, Michael addition and Robinson annelation.

Unit III
Oxidation
Hydrocarbon oxidation, aromatic rings, unsaturated C-H groups (oxidized and unreacted), aldehydes, diols, triols, polyols, ketones, carboxylic acids. Amines, hydrazines, and amines. Oxidations with selenium tetrafluoride, lead tetracetate and sodium (III) nitrate.
Unit IV

Organometallic Reagents

Principle, preparation, properties and applications of the following in organic synthesis, with mechanism details:

- Group I and II metal organic compounds: Li, Mg, Hg, Cd, Zn
- and C6 Compounds

Unit V

Synthesis of some complex molecules:

Application of the above in the synthesis of the following compounds:

- Camphor, longifolene, cortisone, reserpine, vitamin D, juvabion, aphidicolin and
- lindamicin. A

Books Suggested

MCH-698: Electrochemistry
Unit 1
Corona and Stability of Metals:


Unit III

Bioelectrochemistry:

Bioelectrodes, Membrane Potentials, Simplicistic theory, Modern theory. Electrical conductance in biological organisms: Electronic, Protons; electrochemical mechanism of nervous systems, cytochromes as electrodes.

Kinetic of Electrode Process:


Unit IV

Methods of determining kinetic parameters for quasi-reversible and irreversible waves: Koutecky's methods, Manskiseti Method, Gellings method.

Electrocatalysis:

Chemical catalysis and Electrochemical catalysis with special reference to enzymes, porphyrin oxides of rare earths. Electrocatalysis in single crystal reactions, in reaction involving adsorbed species. Influence of various parameters.

Unit V