Vibrational Spectroscopy
Symmetry and shapes of AB2, AB3, AB4, AB5, AB6, mode of bonding of ambidentate ligands, nitro, ethylenediamine and diketomato complexes, Application of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins.

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

Unit -III
Nuclear Magnetic Resonance of Paramagnetic Substances in Solution
Properties of paramagnetic compounds. The contact and pseudo-contact shifts factors affecting nuclear relaxation, contrast agents, shifts reagent, some applications including biochemical systems, an overview of NMR of metal nuclei with emphasis on $^{119}$Pd and $^{117}$Sn NMR.

Mössbauer spectroscopy
Basic principles, instrumentation, chemical shift, spectral display. Application of the technique to the studies of (1) bonding and structure of Fe $^{2+}$ and Fe $^{3+}$ compounds including those of intermediate spin, (2) Sn $^{2+}$ and Sn $^{4+}$ compounds: nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

Electronic Spectroscopy
Electronic Spectral Studies for d$^0$ - d$^9$ systems in octahedral, tetrahedral and square planar complexes.

BOOKS SUGGESTED:
Paper XII
MCH-502: PHOTOCHEMISTRY

Unit I

Photochemical Reactions
Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

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-dienes.
Photochemistry of Aromatic Compounds
Isomerisations, additions and substitutions.

Unit IV

Photochemistry of Carbonyl Compounds
Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, b,g unsaturated and a, b unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.

Unit V
Miscellaneous Photochemical Reactions.
Books Suggested


Metal Ions in Biological Systems
Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co. and K+/Na+ pump.
Bioenergetics and ATP Cycle.
DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll’s, photosystem I and photosystem II in cleavage of water.

Transport and Storage of Dioxygen
Haem proteins and oxygen uptake structure and function of haemoglobin's, myoglobin, haemocyanins and hemerythrin, model synthetic complexes of iron, cobalt and copper.

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

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

Enzymes
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, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition.

Mechanism of Enzyme Action
FOR COLLEGE ONLY

Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotropin, ribonuclease, lysozyme and carboxypeptidase.

**Kinds of Reactions Catalysed by Enzymes**
Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

**Unit IV**

**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 catalyzed by the above cofactors. **Enzyme Models**
Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrion-based enzyme models, cliaxares, ionospheres, micelles synthetic enzymes or synzymes.

**Biotechnological Applications of Enzymes**
Large-scale 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, syrups from corn 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. Helix coils transition.

**Bioenergetics**
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**
FOR COLLEGE ONLY

10. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael ID. Treven, Hohn Wiley.
12. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman

Paper XIV: Elective Paper

Paper XV: Elective Paper
Disconnection Approach
An introduction to synths and synthetic 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, cyclisation reaction, amine synthesis.

Unit II

One Group C-C Disconnections
Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes
and aliphatic Nitro compounds in organic synthesis.

Two Group C-C Disconnections
Diels-Alder Reaction, 1,3-difunctionalised compounds, a-b- unsaturated carbonyl
compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal
addition and Robinson annelation.

Unit III

Oxidation
Introduction. Different oxidative processes. Hydrocarbons-alkenes, aromatic rings,
saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones,
ketals and carboxylic acids. Amines, hydrazines, and sulphides. Oxidations with
ruthenium tetroxide, iodobenzene diacetate and thallium. (III) Nitrate.

Reduction
Introduction. Different reductive processes. Alkanes, alkenes, alkynes, and aromatic
Nitro, nitroso, azo and oxime groups. Exopoxide, Nitro, Nitrosou, azo and oxime groups.
Hydroxymolybdate.

Unit IV

Organometallic Reagents
Principle, preparations, properties and applications of the following in organic synthesis
with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn
and Ce Compounds.

Unit V

Synthesis of some complex molecules:
Application of the above in the synthesis of following compounds:
Campher, longifolene, carisone, reserpine, vitamin D, juvabion, aphidicolin and
fresericamycin. A

Books Suggested
Press.
Wiley.
Press.
Food analysis
Moisture, ash, crude protein, fat, crude fiber, carbohydrates, calcium, potassium, sodium, and phosphate. Food adulteration—common adulterants in food, contamination of foods.

Analysis of Water Pollution

Analysis of soil, fuel, body fluids and drugs
(a) Analysis of soil, moisture pH, total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts.

Clinical Chemistry—Composition of blood—collection and preservation of samples. Clinical analysis: serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates. Immunoassay: principles of radio immunoassay (RIA) and applications. The blood gas analyzer—trace elements in the body.

(b) Drug analysis: Narcotics and dangerous drugs. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometric measurements.

Book Suggested
MCH-609: Medicinal Chemistry

Unit I

Unit II
Pharmacodynamics:
Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit III
Antibiotics and antibacterials
Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular - Streptomycin, Broad spectrum antibiotics - Tetracyclines, Anticancer - Dactinomycin (Actinomycin D)

Unit IV
Antifungal - polyenes, Antibacterial - Ciprofloxacin, Norfloxacin, Antiviral - Acyclovir

Antimalarials: chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine

Unit V
Non-steroidal Anti-inflammatory Drugs: Diclofenac Sodium, Ibuprofen and Netopam

Antihistaminic and antiasthmatic agents: Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate
MCH-608: Electrochemistry

Unit I

1. Conversion and Storage of Electrochemical Energy


Electrochemical-Energy Storage:

Unit II

Corrosion and Stability of Metals:

Unit III

Bioelectrochemistry:
bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes.

Kinetic of Electrode Process:
Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (R0) and Transfer coefficient (a), Exchange Current. Irreversible Electrode processes: Criteria of irreversibility, information from irreversible wave.

Unit IV

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

Electrocatalysis:
Potential Sweep Method:
Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cyclic voltammetry. Controlled current microelectrode techniques: comparison with controlled potentials methods. Chronopotentiometry, theory and applications.

Bulk Electrolysis Methods:
Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis: anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.

Books Suggested:
4. Modern Polarographic Methods by A.M. Bond, Marcel Dekker.
5. Polarography and allied techniques by K. Zutshi, New age International publication, New Delhi.
6. "Electroanalytical Chemistry" by Basil H. Vessor & Galen W.; Wiley Inter science.