

Session 2020-21

PAPER CODE 22-4041

M.Sc CHY Sem. IV Paper -I

(a) Applications of Spectroscopy, (b) Photochemistry, (c) Solid State Chemistry

Scheme of examination:

MM: 70

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 14 marks.

(a) Applications of Spectroscopy

UNIT - I

Nuclear Magnetic Resonance of Paramagnetic Substances in

Solution:

The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ^{195}Pt and ^{119}Sn NMR.

Mossbauer Spectroscopy:

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

UNIT II

Nuclear Magnetic Resonance Spectroscopy: General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides &



mercapto), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with dihedral angle. Simplification of complex spectra nuclear magnetic double resonance, NMR shift reagents, solvent effects, Fourier transform technique, Nuclear Overhauser Effect (NOE).

Carbon-13 NMR Spectroscopy: General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants. Two dimension NMR spectroscopy-COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.

UNIT III

Mass Spectroscopy: Introduction, ion production EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Mc Lafferty rearrangement. Nitrogen rule. High resolution mass spectroscopy. Example of mass spectral fragmentation of organic compounds with respect to their structure determination.

(b) Photochemistry

UNIT IV

Photochemistry of Carbonyl Compounds: Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, β , γ unsaturated and α , β unsaturated compounds, cyclohexadienones. Intermolecular cycloaddition reactions-dimerisations and oxetane formation.

Photochemistry of Aromatic Compounds: Isomerisations, additions and substitutions.

Miscellaneous Photochemical Reactions: Photo-Fries reactions of

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anilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular Oxygen reaction. Photochemical formation of smog. Photo degradation of polymers. Photochemistry of vision.

(c) SOLID STATE CHEMISTRY:

UNIT V

Electronic Properties and Band Theory: Metals, insulators and semiconductors, electronic structure of solids, band theory, Band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors.

Optical properties: Application of optical and electron microscopy.

Magnetic Properties: Classification of materials: Effect of temperature, calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.

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M.Sc CHY Sem. IV Paper -II

PAPER CODE 22-4042

Bio-inorganic, Bio-organic and Bio-physical Chemistry

Scheme of examination:

MM: 52

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Question No. 1 shall be of 10 marks and remaining four questions of 10½ marks each.

UNIT - I

(a) Bio-inorganic Chemistry:

Transport and Storage of Dioxygen:

Haem proteins and oxygen uptake, structure and function of haemoglobin, myoglobin, haemocyanin and hemerythrin, model synthetic complexes of iron, cobalt and copper.

Electron Transfer in Biology: Structure and function of metal of proteins in electron transport process, cytochromes and iron-sulphur proteins, synthetic models.

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

UNIT II

(b) Bio-organic Chemistry

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. Mechanism of reactions catalyzed by the above cofactors.

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Enzyme Models: Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biomimetic chemistry, crown ethers, cryptates. Cyclodextrins, cyclodextrin-based enzyme models, calixarenes, ionophores, micelles, synthetic enzymes or synzymes.

UNIT III

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 IV

(c) Bio-physical chemistry

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, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

UNIT V

Biopolymers and their molecular Weights: Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various

experimental techniques. Sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation velocity, viscosity, electrophoresis and rotational motions.

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Dipen Jain

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M.Sc. CHY Sem. IV Paper -III

Environmental Chemistry

PAPER CODE 22-4043

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT - I

Tropospheric Photochemistry: Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_x . Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.

UNIT II

Green House Effect: Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.

Urban Air Pollution: Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.

UNIT III

Environmental Toxicology-I:

- (a) **Toxic heavy metals:** Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical

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speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.

(b) Toxic Organic Compounds: Pesticides, classification, properties and uses of organochlorine and organophosphorous pesticides, detection and damaging effects.

UNIT IV

Environmental Toxicology-II:

- (a) Polychlorinated biphenyls :** Properties, use and environmental contamination and effects.
- (b) Polynuclear Aromatic Hydrocarbons :** Source, structures and as pollutants.

UNIT V

Environmental Disaster-II

Bhopal gas tragedy, Chernobyl, three mile island, Minimata Disease, Sevoso (Italy), London smog.



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M.Sc CHY Sem. IV Gr. I Paper – IV

PAPER CODE 22-4046

Organotransition Metal Chemistry-II

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Transition Metal π - Complexes – II: Important reactions relating to nucleophilic and electrophilic attack on ligands and organic synthesis.

UNIT II

Transition metal compounds with bonds to hydrogen.

UNIT III

Homogeneous Catalysis-I

Homogeneous Catalysis, Stoichiometric reactions for catalysis, hydrogenation, Zeigler-Natta polymerization of olefins.

UNIT IV

Homogeneous Catalysis-II

Catalytic reactions involving carbon monoxide, oxoreaction, oxopalladation reaction, activation of C-H bond.

UNIT V

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Dipak Jain



Fluxional Organometallic Compounds

Fluxionality and dynamic equilibria in compounds such as η^2 - olefine, η^3 -allyl and dienyl complexes.



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M.Sc CHY Sem. IV Gr. I Paper - V

PAPER CODE 22-4045

Bio-inorganic and supramolecular Chemistry-II

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT - I

Metals in Medicine: Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and chemotherapy with particular reference to anticancer drugs.

UNIT II

Metalloenzymes-II: Copper enzymes-superoxide dismutase. Molybdenum oxatransferase enzymes-xanthine oxidase. Coenzyme vitamin B12.

UNIT III

Metal-Nucleic Acid Complexes: Metal ions and metal complex interactions. Metal complex nucleic acids.

UNIT IV

Supramolecular Chemistry-II(A): Transport processes and carrier design.

UNIT V

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Supramolecular Chemistry-II(B):

Supramolecular devices. Supramolecular photochemistry, supramolecular electronic, ionic and switching devices.



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M.Sc CHY Sem. IV Gr. I Paper – VI

PAPER CODE 22-4046

Photo-inorganic Chemistry-II

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Basics of Photochemistry-II: Energy dissipation by radiative and non-radiative processes, absorption spectra, Frank-Condon principle, photochemical stages-primary and secondary processes.

UNIT II

Excited States of Metal Complexes

Excited states of metal complexes : Comparison with organic compounds, electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations.

UNIT III

Ligand Field Photochemistry – II: Energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

UNIT IV

Redox Reactions by Excited Metal Complexes – III: Excited electron transfer, metal complexes as attractive candidates, (2,2-bipyridine and 1,10-phenanthroline complexes), illustration of reducing and oxidising

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character of Ruthenium (Ru^{+2}) (bipyridal complex), comparison with Fe (bipy)₃; role of spin-orbit coupling-life time of these complexes.

UNIT V

Metal Complex Sensitizers: Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction.



Siraj Jaiu



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M.Sc CHY Sem. IV Gr. I Paper – VII

PAPER CODE 22-4047

Polymers - II

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Polymer Characterization – II: Analysis and testing of polymers- chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength, fatigue, impact, tear resistance, hardness and abrasion resistance.

UNIT II

Inorganic Polymers: A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers.

UNIT III

Structure, Properties and Applications of Polymers based on Silicon, silicones, polymetalloxanes and polymetallosiloxanes, silazanes.

UNIT IV

Structure, Properties and Applications (D): Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds.

UNIT V

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Structure, Properties and Applications (E): Co-ordination and metal
chelate polymers.

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Dr. Jyoti J. Patil



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M.Sc CHY Sem. IV Gr. II Paper – IV

Organic Synthesis-II

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Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Organometallic Reagents – II:

Principle precipitation, properties and applications of the following in organic synthesis with mechanistic details. Transition metals. Cu, Pd, Ni, Fe, Co, Rh, Cr, and Ti compounds. Other elements S, Si, B and I compounds.

UNIT II

Reduction - I: Introduction, Different reductive processes. Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives.

UNIT III

Reduction - II: Epoxides, Nitro, nitroso, azo and oxime groups. Hydrogenolysis.

UNIT IV

Metalloenes, Nonbenzenoid Aromatics Compounds and Polycyclic Compounds – I: General consideration. Synthesis and reactions of some representative compounds. (Tropone, tropolone, azulene.)

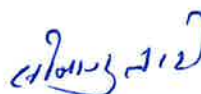

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UNIT V

Metalloenes, Nonbenzenoid Aromatics Compounds and Polycyclic Compounds – II: General consideration. Synthesis and reactions of some representative compounds. (Ferrocene, phenanthrene, fluorine and indene).

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M.Sc CHY Sem. IV Gr. II Paper – V

PAPER CODE 22-4049

Organic Synthesis-IV

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Two Group C-C Disconnections-I: Diels-Alder Reaction, 1,3-difunctionalised compounds, α , β -unsaturated carbonyl compounds, control in carbonyl condensations.

UNIT II

Two Group C-C Disconnections-II:

1,5-difunctionalised compounds. Micheal addition and Robinson annélation.

UNIT III

Ring Synthesis: Saturated heterocycles, synthesis of 3,4,5 and 6 membered rings. aromatic heterocycles in organic synthesis.

UNIT IV

Synthesis of Some Complex Molecules – I: Application of the above in the synthesis of following compounds: Camphor, Longifoline, Cortsone, Reserpine.

UNIT V

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**Synthesis of Some Complex Molecules – II: Vitamin D, Juvabione,
Aphidicolin and Fredericamycin A.**

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M.Sc CHY Sem. IV Gr. II Paper – VI

Heterocyclic Chemistry-II

PAPER CODE 22-4050

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Non-aromatic Heterocycles: Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereoelectronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions.

UNIT II

Heterocyclic Synthesis: Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions.

UNIT III

Meso-ionic Heterocycles

General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

UNIT IV

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Benzo-Fused Five-Membered Heterocycles

Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.

UNIT V

Heterocyclic Systems Containing P: Heterocyclic rings containing phosphorus, Introduction, nomenclature, synthesis and characteristics of 5- and 6-membered ring systems - phosphorinanes, phosphorines, phospholanes and phospholes.

Heterocyclic rings containing As and Sb: Introduction, synthesis, reactivity and special characteristics of 3-, 5- and 6-membered ring system.

Heterocyclic rings containing B: Introduction, synthesis, reactivity and spectral characteristics of 3- 5- and 6- membered ring systems.



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M.Sc CHY Sem. IV Gr. II Paper – VII

Chemistry of Natural Products-II

PAPER CODE 22-4051

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Steroids – I: Occurrence, nomenclature, classification, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, structure, determination and synthesis of Cholesterol and Bile acids.

UNIT II

Steroids – II: Structure, determination and synthesis of Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of Steroids.

UNIT III

Plant Pigments – I: Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quereentin, β -glucoside and Vitexin.

Plant Pigments – II: Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Diadzein, Buttein, Ireusin Cyanidin-7, arabinoside, Cyanidin, Esutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.

UNIT IV

Prophyrins: Structure and synthesis of Haemoglobin and Chlorphyll.

UNIT V

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Pyrethroids and Rotenones: Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible).



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M.Sc CHY Sem. IV Gr. III Paper – IV

Analytical Chemistry-II

PAPER CODE 22-4052

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Introduction: Sample separation-dissolution and decompositions. Gravimetric techniques. Selecting and handling of reagents. Laboratory notebooks. Safety in the analytical laboratory.

UNIT II

Analysis of Water Pollution – II:

Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as water pollutants and analysis. Water pollution laws and standards.

UNIT III

Analysis of soil and Fuel: (a) Analysis of Soil, moisture pH, total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts.

(b) Fuel analysis : liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point, octane number and carbon residue. Gaseous fuels-producer gas and water gas-calorific value.

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UNIT IV

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 analysis trace elements in the body.

UNIT V

Drug analysis : Narcotics and dangerous drugs. Classification of drugs. Screeing by gas and hing-layer chromatography and spectrophotometric measurements.

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M.Sc CHY Sem. IV Gr. III Paper – V

PAPER CODE 22-4053

Physical Organic Chemistry-II

Scheme of examination:

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Acids, Bases, Electrophiles, Nucleophiles and Catalysis: Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity functions and their applications. hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The α -effect. Ambivalent nucleophiles. Acid-base catalysis-specific and general catalysis. Bronsted catalysis, Nucleophilic and electrophilic catalysis. Catalysis by noncovalent binding-micellar catalysis.

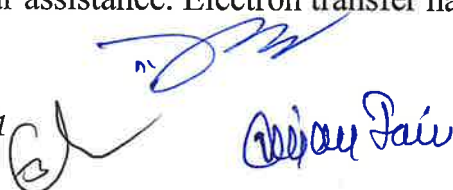
UNIT II

Steric and Conformation Properties: Various type of steric strain and their influence on reactivity. Steric acceleration. Molecular measurements of steric effects upon rates. Steric LFET, Conformational barrier to bond rotation-spectroscopic detection of individual conformers. Acyclic and monocyclic systems. Rotation around partial double bonds. Winstein-Holness and Curtin-Hammett principle.

UNIT III

Nucleophilic and Electrophilic Reactivity: Structural and electronic effects on SN1 and SN2 reactivity. Solvent effect Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of SN2 reaction.

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Nucleophilicity and SN2 reactivity based on curvedcrossing mode.
Relationship between polar and electron transfer reactions SRN1
mechanism. Electrophilic reactivity, general mechanism. Kinetic of SE2
Ar reaction. Structural effects on rates and selectivity. Curve-crossing
approach to electrophilic reactivity.

UNIT IV

Radical and Pericyclic Reactivity: Radical stability, polar influences,
solvent and steric effects. A curve crossing approach to radical addition,
factors effecting barrier heights in addition, regioselectivity in radical
reactions. Reactivity, specificity and periselectivity in pericyclic
reactions.

UNIT V

Supramolecular Chemistry: Properties of covalent bonds-bond length,
inter-bond angles, force constant, bond and molecular dipole moments.
Molecular and bond polarizability, bond dissociation enthalpy, entropy.
intermolecular forces, hydrophobic effects. Electrostatic, induction,
dispersion and resonance energy, magnetic interactions, magnitude of
interaction energy, forces between macroscopic bodies, medium effects.
Hydrogen bond. Principles of molecular association and organization as
exemplified in biological macromolecules like enzymes, nucleic acids,
membranes and model system like micelles and vesicles. Molecular
receptors and design principles. Cryptands, cyclophanes, calixeranes,
cyclodextrines. Supramolecular reactivity and catalysis. Molecular
channels and transport processes, Molecular devices and nanotechnology.



Deviyani Jain



Chemical Dynamics-II**Scheme of examination:**

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I**Radiation Chemistry:** Radiation chemistry and photochemistry.

Radiation chemistry of water and aqueous solutions. Hydrogen atom and hydroxyl radical-oxidizing and reducing conditions. Kinetics and mechanism of photochemical and photosensitized reactions (One example in each case). Stern-Volmer equation and its application. Hole-concept in the presence of semiconductor type photocatalysis. Kinetics and mechanism of electron transfer reaction in the presence of visible light. Kinetics of exchange reactions (Mathematical analysis).

UNIT II

Transition State: A brief aspect of statistical mechanics and transition state theory. Application in calculation of the second order rate constants for reactions with collision for (1) and + (2) atom + molecular (3) + molecule reactions. Static solvent effects and thermodynamics formulations. Adiabatic electron transfer reactions, energy surfaces.

UNIT III

Substitution Reactions – I: Substitution reactions. Classification of ligand substitution mechanism. Anation and base catalyzed kinetics of anation reactions. Aquation and acid catalyzed kinetics of aquation reactions (octahedral complexes). Inner-sphere electron transfer reactions





and mechanism. Various types of inner sphere bridges, adjustment and remote attack. Linkage isomerism.

UNIT IV

Substitution Reactions – I: Chemical and resonance mechanism.

Marcus-Cross relation in outersphere reactions (no mathematical derivation). Its application in reactions : $\text{Ce(IV)} + \text{Mo(CN)}_6^{4-} \rightarrow \text{Ce(III)} + \text{Mo(CN)}_6^{3-}$, $\text{Fe(CN)}_6^{3-} + \text{Fe(CN)}_6^{4-} \rightarrow \text{Fe(CN)}_6^{4-} + \text{Fe(CN)}_6^{3-}$ Bridged outer-sphere electron transfer mechanism. Kinetics of reactions in the presence of cyclodextrines. Considering one full case study, Nucleophilic and electrophilic catalyst and their mode of action.

UNIT V

Metal ion catalysis and induced Phenomena: Metal ion catalyzed reactions, their kinetics and reaction mechanism in solutions. Induced reactions, their characteristics. Mechanism of (i) Fe (II) induced oxidation of iodine by Cr(VI). (ii) As (III) induced oxidation of Mn (II) by chromate in acid solutions. Kinetics and mechanism of induced reactions in metal complexes (octahedral complexes of Cobalt (III) only). Kinetics of hydroformylation reaction.



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Electrochemistry-II**Scheme of examination:**

MM: 35

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.
2. Each question shall be of 7 marks.

UNIT – I

Corrosion and Stability of Metals: Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diagrams; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate: (i) Weight Loss method, (ii) Electrochemical Method.

UNIT II

Inhibiting Corrosion : Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors.

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.

UNIT IV

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.

UNIT V

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.



Deviyani Devi



Quantitative d M. Sc (F) Chemistry Practical
Practical

INORGANIC CHEMISTRY, SEMESTER-IV

Determinations of a three component mixture :

One Volumetrically and two gravimetrically

PAPER CODE ..P-22-4057

- a. Cu^{+2} , Ni^{+2} , Zn^{+2}
- b. Cu^{+2} , Ni^{+2} , Mg^{+2}

Chromatographic Separations

- a. Cadmium and zinc
- b. Zinc and magnesium.
- c. Thin-layer chromatography-separation of nickel, manganese, cobalt and zinc. Determination of R_f values.
- d. Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R_f values.

Organic Chemistry

Multi-step Synthesis of Organic Compounds

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

Photochemical reaction

Benzophenone \rightarrow Benzpinacol \rightarrow Benzpinacolone

Beckmann rearrangement : Benzanilide from benzene Benzene \rightarrow Benzophenone \rightarrow Benzophenone oxime \rightarrow Benzanilide

Benzilic acid rearrangement : Benzilic acid from benzoin

Benzoin \rightarrow Benzil \rightarrow Benzilic acid

Synthesis of heterocyclic compounds

Skraup synthesis : Preparation of quinoline from aniline Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine. Enzymatic synthesis Enzymatic synthesis

Enzymatic reduction : reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S (+) ethyl-3-hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose.

Synthesis using microwave

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Alkylation of diethyl malonate with benzyl chloride. Synthesis using phase transfer catalyst.

Alkylation of diethyl malonate or ethyl acetoacetate with an alkylhalide

Paper Chromatography

Separation of identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R_f values.

Spectroscopy

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS)

Spectrophotometric (UV/VIS) Estimations

1. Amino acids
2. Proteins
3. Carbohydrates
4. Cholesterol
5. Ascorbic acid
6. Aspirin
7. Caffeine

Physical Chemistry

~~Number of hours for each experiment : 3-4 hours. a list of experiments under different headings are given below. Typical experiments are to be selected from each type.~~

Physical chemistry

Number of Hours to each experiment : 3-4 Hours.

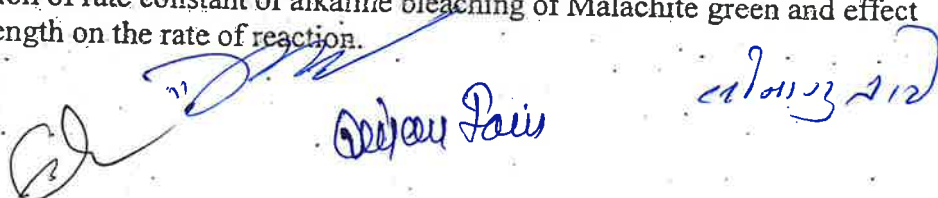
A list of experiments under different headings are given below. Typical experiments are to be selected from each type.

(A) Electronics

- i. Verify Beer's law for the solution of KMnO_4 and determine the concentration of the given aqueous solution of unknown concentration of this salt.
- ii. Verify Beer's law using K_2CrO_4 solution
- iii. Determine the P^{H} of the solution employing methyl red indicator spectrophotometrically.
- iv. Determine the indicator constant ($\text{p}k_a$) of methyl red spectrophotometrically.

(B) Spectroscopy

- i. Determination of k_{Pa} of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
- ii. Determination of stoichiometry and stability constant of Ferricisothiocyanation complex ion in solution.
- iii. Determination of rate constant of alkaline bleaching of Malachite green and effect of ionic strength on the rate of reaction.



(C) Polarography

- i. Identification and estimation of metal ions such as Cd^{+2} , Pb^{+2} , Zn^{+2} , and i^{+2} etc. polarographically.
- ii. Study of a metal ligand complex polarographically (using Lingane's Method).

(D) Chemical Kinetics

- i. Determination of rate constant and formation constant of an intermediate complex in the reaction of Ce(IV) and Hypophosphorous acid at ambient temperature.
- ii. Determination of energy and enthalpy of activation in the reaction of KMnO_4 and benzyl alcohol in acid medium.
- iii. Determination of energy of activation of and entropy of activation from a single kinetic run.
- iv. Kinetics of an enzyme catalyzed reaction.

(E) Electronics

This lab course will have theory as well as practicals and the lectures shall be delivered during lab hours.

Basic Electronics

Notations used in the electronic circuit, study of electronic compounds and colour codes. Conversion of chemical quantities into electronic quantities. transducer, illustration with electrodes, thermocouples and thermistors.

Passive components : Resistors, capacitors and inductors with some emphasis on solid state properties of materials. Net works of resistors. Thevenin's theorem; superposition theorem, loop analysis; RC circuits, LR Circuits, LCR circuits. Illustration of the use of circuits in NQR spectroscopy, Mossbauer spectroscopy cyclic voltammetry and in power supplied as filter circuits.

Active components

Introduction to ordinary diodes and Zener diode with some emphasis on p-n junction as a solid state property. Use of diode as rectifiers, clipping and clamping circuits. Power supplies. Transistors : An extension of p-n-p and n-p-n transistors. Characteristics of transistors, hybrid parameters; transistor circuits as amplifiers, high impedance (preamplifier) circuits. Darlington pairs, differential amplifiers.

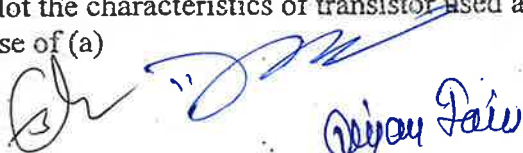
Operational Amplifiers

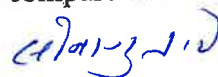
Ideal characteristics; inverter, summer, integrator, differentiator, voltage follower, illustrative use of operational amplifiers. Introduction to Fourier transformation in instrumentation.

List of Experiments in electronics

(Do at least five experiments from this section)

1. (a) To plot the diode characteristics and find its dynamic resistance and cut in voltage.
(b) To plot the characteristics of transistor used as a diode and compare the results with those of (a)


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2. To implement a diode clipper circuit for the given transfer characteristics and verify the wave form
3. To implement a diode clamper circuit which clamps the positive peak of the input voltage to (a) Zero voltage and (b) a given voltage. Verify the performance.
4. (a) To plot the characteristics of an NPN transistor in CE configuration.
(b) To find the h -parameter of the transistor from the characteristics.
5. (a) To plot the characteristics of an NPN transistor in CB configuration.
(b) To find the h -parameter of the transistor from the characteristics and compare it with the results of experiment No. 6.
6. (a) To plot the drain and transfer characteristics of a JFET in CS configuration.
(b) To find out the pinch off voltage, maximum drain to source saturation current and the transconductance.
7. To obtain the frequency response of an RC coupled amplifier and estimate the bandwidth.
8. (a) To plot the characteristics of Zener diode and find its dynamic resistance under reverse biased condition.

(b) To use zener diode for a voltage regulation.

(i) Plot the line regulation curve.

(ii) Plot the load Regulation curve.

9. (a) To wire a Half wave Rectifier circuit using diode and measure the rms voltage, dc voltage and to find Ripple factor
(b) To study the performance of half wave and full wave doubler circuits.
10. To plot the characteristics of UJT and find the peak voltage, peak current and valley voltage and use as a relaxation oscillator.

Note : A sheet containing 20 questions/diagrams/circuits will be provided to the students to reply. These questions based on basic electronics will cover both theory and practicals as provided in the syllabi. They will be of objective type for duration of 20 minutes with maximum scoring of 10 marks.

Books Suggested.

1. Inorganic Experiments, J. Derek Woolings, VCH.
2. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
3. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrand.
4. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curtin

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