Session 2022-23

M.Sc CHY Sem. III Paper –I

PAPER CODE 22-3041

(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

Vibrational Spectroscopy: Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, mode of bonding of ambidentate ligands, ethylenediamine and diketonato 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 such as PH_4, F_2^- and (BH_3^-).

Organic Chemistry

UNIT – II

(a) **Ultraviolet and Visible spectroscopy:** Various electronic transitions (185-800 nm) Beer-Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.

(b) Optical Rotatory Dispersion (ORD) and Circular Dichroism

(CD): Definition, deduction of absolute configuration, octant rule for ketones.

UNIT - III

Infrared Spectroscopy: Instrumentation and Sample handling: Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ether's, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.

(b) Photochemistry

Unit-IV

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

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.

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

(c) **SOLID STATE CHEMISTRY**

Unit-V

Solid State Reactions: General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.

Crystal Defects and Non-Stoichiometry: Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.

Organic Solids: Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.

Sessim 2022-23

PAPER CODE 22-3042

M.Sc CHY Sem. III Paper –II

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) BIOINORGANIC CHEMISTRY

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.

Unit-II

(b) : BIOORGANIC CHEMISTRY

Introduction: Basic considerations, Proximity effects and molecular adaption.

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 Koshalnd'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.

UNIT - III

Mechanism of Enzyme Action: Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, 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, β-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

Unit-IV

(c) : BIOPHYSICAL CHEMISTRY

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

Statistical Mechanics in Biopolymers: Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures, introduction to protein folding problem.

UNIT - V

Thermodynamics of Biopolymers Solutions: thermodynamics of Biopolymer Solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.

Cell Membrane and Transport of Ions: Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

Session 2020-21

Session 2022-23

M.Sc CHY Sem. III Paper –III

Environmental Chemistry PAPER CODE 22-3043

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

Atmosphere: Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphure, phosphorus oxygen. Residence times.

Unit-II

Atmospheric Chemistry: Sources of trace atmospheric constituents : nitrogen oxides, sulphure dioxide and other sulphure compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.

Unit-III

Air Pollution: Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health.

Acid Rain: Definition, Acid rain precursors and their aqueous and gas phase atmospheric Oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO2 and NOx. Acid rain control strategies.

Stratospheric Ozone Depletion: Mechanism of Ozone formation,

Mechanism of catalytic Ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies.

Unit-IV

Aquatic Chemistry and Water Pollution: Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Eutrophication, Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.

Unit-V

Soil: Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic and metals. Methods of re-mediation of soil.

Session 2022-23

M.Sc CHY Sem. III Gr. I Paper – IV

PAPER CODE 22-3044

Organotransition Metal Chemistry-I

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

Alkyls and Aryls of Transition Metals Types, routes of synthesis, stability and decomposition pathways organocopper in organic synthesis.

Unit-II

Compounds of Transition Metal-Carbon Multiple Bond-I alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics.

Unit-III

Compounds of Transition Metal-Carbon Multiple Bond-II Nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.

Unit-IV

Transition Metal π-Complexes-I Unsaturated organic molecules, alkenes, alkynes, allyl preparation, Transition Metal π -Complexes with properties, nature of bonding and structural features.

Unit-V

Transition Metal π-Complexes-II

Diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonding and structural features.

Session 2020-21

Session 2022-23

PAPER CODE 22-3045

M.Sc CHY Sem. III Gr. I Paper – V

Bio-inorganic and supramolecular Chemistry-I

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

Metal Storage and Transport

Ferritin transferrin, and siderophores.

Unit-II

Calcium in Biology

Calcium in living cells, transport and regulation, molecular, aspects of intramolecular processes, extracellular binding proteins.

Unit-III

Metalloenzymes

Zinc enzymes-carboxypeptidase and carbonic anhydrase. Iron enzymes-catalase, peroxidase and cytochrome P-450.

Unit-IV

Supramolecular Chemistry-I

Molecular recognition : Molecular receptors for different types of molecules including arisonic substrates, design and synthesis of co receptor molecules and multiple recognition.

UNIT – V

Supramolecular Chemistry-II

Supramolecular reactivity and catalysis.

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Session 2020-21

Session 2022-23

M.Sc CHY Sem. III Gr. I Paper – VI

PAPER CODE 22-3046

Photo-inorganic Chemistry-I

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-I

Absorption, excitation, photochemical laws, quantum yield, electrically excited states-life times-measurements of the times. Flash photolysis.

UNIT-II

Properties of Excited States

Structure, dipole moment, acid-base strengths, reactivity. Photochemical kinetics-calculation of rates of radiative processes. Bimolecular deactivation-quenching.

Unit-III

Ligand Field Photochemistry-I

Photosubstitution, photooxidation and photoreduction, lability and selectivity, zero vibrational levels of ground state and excited state.

Unit-IV

Redox Reactions by Excited Metal Complexes-I

Energy transfer under conditions of weak interaction and strong interaction-exciplex formation; condition of the excited states to be useful as redox reactants.

Unit-V

Redox Reactions by Excited Metal Complexes-II

Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants into high energy products, chemical energy into light.

Session 2022-23

M.Sc CHY Sem. III Gr. I Paper – VII

PAPER CODE 22-3047

Polymers - I

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: Importance of polymers. Basic concepts : Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization : condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.

Unit-II

Polymer Characterization

Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity an molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.

Unit-III

(A) Structure, Properties and Applications of

Polymers based on boron-borazines, boranes and carboranes.

UNIT- IV

(B) Structure, Properties and Applications of Polymers based on Phosphorous-Phosphazenes, Polyphosphates

Unit-V

(C) Structure, Properties and Applications of: Metal clusters.

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Session 2022-23

M.Sc CHY Sem. III Gr. II Paper – IV

PAPER CODE 22-3048

Organic Synthesis-I

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-I

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-II

Oxidation – I: Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids.

Unit-III

Oxidation – II: Amines, hydrazines and sulphides. Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium (III) Nitrate.

Unit-IV

Rearrangements-I: General mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements. Pinacol-pinacolone, Wagner-Meerwein,

Demjanov, Benzil-Benzillic acid. Favorskii, Arndt-Eister synthesis, Neber.

Unit-V

Rearrangements-II: Beckmann, Hofmann Curtius, Schmidt, Baeyer-Villiger, Shapiro reaction.

Session 2022-23

M.Sc CHY Sem. III Gr. II Paper – V

PAPER CODE 22-3049

Organic Synthesis-III

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

Disconnection Approach-I: An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis.

UNIT-II

Disconnection Approach-II: one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis.

Unit-III

Protecting Groups: Principle of protection of alcohol, amine, carbonyl and carboxyl groups.

Unit-IV

One Group C-C Disconnections-I: Alcohols and carbonyl compounds, regioselectivity.

Unit-V

One Group C-C Disconnections-II: Alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis.

Session 2020-21

Session 2022-23

M.Sc CHY Sem. III Gr. II Paper – VI

PAPER CODE 22-3050

Heterocyclic Chemistry-I

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

Nomenclature of Heterocycles: Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles.

UNIT-II

Aromatic Heterocycles: General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in ^{1}H-NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.

Unit-III

Small Ring Heterocycles: Three-membered and four-membered heterocycles-synthesis and reactions of azirodines, oxiranes, thiranes, azetidines, oxetanes and thietanes.

Unit-IV

Six-Membered Heterocycles with one Heteroatom: Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts, phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.

Six Membered Heterocycles with Two or More Heteroatoms Synthesis and reactions of diazines, triazines, tetrazines and thiazines.

Unit-V

Seven-and Large-Membered Heterocycles Synthesis and reactions of azepines, oxepines, thiepines, diazepines thiazepines, azocines, diazocines, dioxocines and dithiocines.

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Session 2021-2

M.Sc CHY Sem. III Gr. II Paper – VII

PAPER CODE 20-3051

Chemistry of Natural Products-I

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

Terpenoids-I: Clasification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral, Gerniol α-Terpeneol.

UNIT-II

Terpenoids-I and and Carotenoids: Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Menthol, Farnesol, Zingiberence, Santonin, Phytol, Abietic acid and b-Carotene.

Unit-III

Alkaloids-I: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants.

UNIT-IV

Alkaloids-II: Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine , (+)- Conine, Nicotine, Atropine, Quinine and Morphine.

Unit-V

Prostaglandis: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE_2 and $PGF_{2\alpha}$.

Session 2022-23

M.Sc CHY Sem. III Gr. III Paper – IV

PAPER CODE 22-3052

Analytical Chemistry-I

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: Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness. laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware.

Unit-II

Errors and Evaluation-I: Definition of terms in mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of error in experimental data determinate (systematic), indeterminate (or random) and gross.

Unit-III

Errors and Evaluation-II: Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.

UNIT-IV

Food analysis: Moisture, ash, crude protein, fat crude fibre, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulteratnts in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in food prodcuts. Extraction and purification of sample. HPLC. Gas

chromatogrphay for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.

Unit-V

Analysis of Water Pollution-I: Origin of Waste water, types, water pollutants and their effects. Sources of water pollution-domestic, industrial, agriculatural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alakalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen.

Session 2022-23

M.Sc CHY Sem. III Gr. III Paper – V

PAPER CODE 22-3053

Physical Organic Chemistry-I

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

Concepts in Molecular Orbital (MO) and Valence Bond (VB) Theory : Introduction to Huckel molecular orbital (MO) method as a mean to explain mdoern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics, semi empirical methods and abinito and density functional methods. Scope and limitations of several computational programmes.

Quanitative MO theory : Huckel molecular orbital (HMO - method as applied to ethene, allyl and butadiene. Qualitative MO theory ionisation potential. Electron affinities. MO energy levels. Orbital symmetry. Orbital interaction diagrams. MO of simple organic systems such as ethene, allyl, butadiene, methane and methyo group. Conjugation and hypeconjugation. Aromaticity.

Valence bond (VB) configuration mixing diagrams. Relationship between VB configuration mixing and resonance theory. Reaction profiles. Potential energy diagrams. Curve-crossing model-nature of activation barrier in chemical reactions.

~~Unit-II~~

Principles of Reactivity: Mechanistic significance of entropy, enthalphy and Gibb's free energy. Arrrhenius equation. Transition state theory. Uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi Principle. Potential energy surface model. Marcus theory of electron transfer. Reactivity and selectivity principles.

Unit-III

Kinetic Isotope Effect: Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects.

Unit-IV

Structural Effects on Reactivity: Linear free energy relationships (LFER). The Hammett equation, substitutent constants, theories sof substitutent effects. Interpretation of σ-values. Reaction constantp. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, σ 1 and σ R scales.

Unit-V

Solvation and Solvent Effects: Qualitative understanding of solvent-solute effects on reactivity. Thermodynamic measure of solvation. Effects of solvation on reaction rates and equilibria. Various empirical indexes of solvation based on physical properties, solvent-sensitive reaction rates, spectroscopic properties and scales for specific solvation. Use of solvation scales in mechanistic studies. Solvent effects from the curve-crossing model.

Session 2022-23

M.Sc CHY Sem. III Gr. III Paper – VI

PAPER CODE 22-3054

Chemical Dynamics-I

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

Atmospheric Reactions-I: Physical structure of the atmosphere, chemical composition of the atmosphere, Kinetic and mechanism of NOx, ClOx cycles and H_2+O_2 reaction. Mechanism of general methane oxidation.

Unit-II

Atmospheric Reactions-II:

(a)Kinetics and mechanism of low temperature oxidation of methane. Concept of global warming.

(b) **Oscillatory Reactions:** Autocatlysis and oscilatory reactions, Kinetics and mechanism of Belousov-Zhabotinski (B-z) reactions.

Unit-III

Enzymes and Inhibitions: Kinetics of one enzymes-Two substrate systems and their experimental characteristics. Enzyme inhibitiors and their experimetnal characteristics. Kinetics of enzyme inhibited reactions.

Unit-IV

Micelles catalysis and inhibition: Kinetics and mechanism of micelle catalyzed reactions (Ist order and second order) Various type of micelle cataeyzed reactions. Micelle inhibited reactions.

Unit-V

Dynamics of Gas-surface Reactions: Adsorption/desorption kinetics and transitin state theory. Dissociative adsorption and precursor state. Mechanism of Langimur's adsorption of the oxidation of carbon monoxide to carbon dioxide. True and apparent activation energies. Industrial imporance of heterogeneous catalysis.

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Session 2022-23

M.Sc CHY Sem. III Gr. III Paper – VII

PAPER CODE 22-3055

Electrochemistry-I

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

Conversion and Storage of Electrochemical Energy Present status of energy consumption: Pollution problem, History of fuel cells, direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs.

electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkaline fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

Unit-II

Electrochemical Energy Storage: Properties of Electrochemical energy stores: Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries: (i) Lead Acid (ii) Nickel-Cadmium. Modern Batteries: (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers: Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.

Unit-III

Irreversible Electrode processes : Criteria of irreversibility, informatino from irreversible wave.

Methods of determining kinetic parameters for quasi-rversible and

irreversible waves : Koutecky's methods, Meits Israel Method, Gellings method.

Unit-IV

Electrocatalysis: Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.

Unit-V

Kinetic of Electrode Process: Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K^0) and Transfer coefficient (α), Exchange Current.

Session 2022-23

M. Sc (F) Chemistry Practical
Practical
SEMESTER-III

PAPER CODE P-22-3057

Duration: 14 Hrs (in 2 days)

Max Masks: 200

Preparation

Preparation of selected inorganic compounds and their study by IR, electronic spectra, Mossbaurer, ESR and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines.

Selection can be made from the following

1. Sodium amide. Inorg. Synth., 1946, 2, 128.
2. Synthesis and thermal analysis of group II metal oxalate hydrate. J. Chem. Ed., 1988, 65, 1024.
3. Atomic absorption analysis of Mg and Ca.
4. Trialkoxyboanes-IR and NMR spectra.
5. PhBd2 Dichlorophenylborane - Synthesis in vacuum line.
6. Preparation of Tin (IV) iodide, Tin (IV) chloride and Tin (II) iodide, Inorge, Synth., 1953, 4.119.
7. Relative stability of Tin (IV) and Pb (IV). Preparation of ammonium hexachlorostannate (NH4)2 SnCl6 ammonium hexachlorophlumbate (NH4)2PbCl6.
8. Hexa-bis (4,nitrophenoxy) cyclotriphosphazene.
9. Synthesis of trichlorodiphenylantimony (V) hydrate. Inorg. Synths., 1985, 23, 194
10. Sodium tetrathionate Na2S4O6.
11. Metal complexes of dimethyl sulfoxide (IR) : CuCl2.2DMSO, PdCl2. 2DMSO, RuCl2. 4DMSO. J.Chem. Educ., 1982, 59, 57.
12. Synthesis of metal acethylacetonate : Magnetic moment, IR, NMR, Inorg. Synths, 1957, 5, 130, 1963, 1, 183.
13. Bromination of Cr (acac)3. J. Chem. Edu., 1986, 63, 90.
14. Magnetic moment of Cu (acac)2H2O.
15. Cis and Trns [Co(en)2Cl2]+.
16. Separation of optical isomer of cis-[Co(en)2Cl2]Cl.J. Chem. Soc., 1960. 4369.
17. Ion exchange separation of oxidation state of vanadium. J. Chem. Educ., 1980, 57, 316; 1978, 55, 55.
18. Determination of Cr (III) complexes. [Cr(H2O)6]NO3.3HO, [Cr(H2O)4Cl2]Cl.2H2O, [Cr(en)3]Cl3, Cr(acac)3. Inorg. synths., 1972, 13, 184.
19. Preparation of N, N bis (salicycladehyde) ethylenedimine, salen H2. Co(Salen) J. Chem. Educ., 1977, 54, 443; 1973, 50, 670.
20. Preparation of Fe(II) chloride (use it as Friedel-Craft chlorination source) J. Org. Chem., 1978, 43, 2423; J. Chem. Edu., 1984, 61, 645; 1986, 63, 361.
21. Reaction of Cr(III) with a multidentate ligand; a kinetics experiment (visible spectra Cr-EDTA complex) J.A.C.S., 1953, 75, 6570.
22. Preparation and use of Ferrocene. J. Chem. Edu. 1966, 43, 73; 1976, 53, 730.
23. Preparation of copper glycine complex-cis and trans bis (glycinato Copper (II). J. Chem. soc. Dalton, 1979, 1901, J. Chem. Edu., 1982, 59, 1052.
24. Preparation of phosphine Ph3P and its transition metal complexes.
25. Preparation of [Co(phenathroline-5,6 quinone)].
26. Any other experimetn such as conversion of p-xylene to terephtalic acid catalyzed
27.
28. by CoBr2 (homogeneous catalysis)

Dipak Dalui

M. Sc (F) Chemistry Practical
Practical
SEMESTER-III

Spectrophotometric Determinations

a. Manganese/Chromium/Vanadium in steel sample.
b. Nickel/molybdenum/tungston/vanadium/uranium by extractive spectrophotometric method.
c. Fluoride/nitrite/phosphate.
d. Zirconium-alizarin Red-S complex : Mole-ratio method.
e. Iron-phenanthroline complex : Job's method of continuous variations. Iron-phenanthroline complex : Job's method of continuous variations.
f. Copper-Ethylene diamine complex : Slope-ratio method.

Flame Photometric Determinations

a. Sodium and potassium when present together.
b. Lithium/calsium/barium/strontium.
c. Cadmium and magnesium in tap water.

Organic Chemistry

Qualitative Analysis
Separation, purification and identification of the components of a mixture of three organic compounds (three solids or two liquids and one solid or two solids and one liquid), using tc for checking the purity of the separated compounds, chemical analysis, IR, PMR and mass spectral data.

Extraction of Organic Compounds from Natural Sources

1. Isolation of caffeine from tea leaves.
2. Isolation of casein from milk (the students are required to try some typical colour reactions of proteins).
3. Isolation of lactose from milk (purity of sugar should be checked by LC and PC and Rf values reported).
4. Isolation of nicotine dipicrate from tobacco.
5. Isolation of cinchonine from cinchona bark.
6. Isolation of piperine from black pepper.
7. Isolation of lycopene from tomatoes.
8. Isolation of b-carotene from carrots.
9. Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid).
10. Isolation of eugenol from clove.
11. Isolation of (+) limonine from citrus rind.

M. Sc (F) Chemistry Practical
Practical
SEMESTER-III

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) Thermodynamics

i. Determination of partial molar volume of solute (e.g. KCl) and solvent in a binary mixture.
ii. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intromolecular in tetractions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution.

(B) Spectroscopy

i. Determination of kPa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
ii. Determination of stoichiometry and stability constant of Ferricisothicoyanation 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).