

4. Practical Inorganic Chemistry : G. Marr, B.W. Rockett Van Nostrand.

PAPER -V (CH-1.1.5)

ORGANIC CHEMISTRY PRACTICAL

FM-50

Time: 6 hrs.

Separation, purification and identification of compounds of binary mixtures (solid-solid, solid-liquid, liquid-liquid) using TLC and column chromatography, Chemical tests.

Books Recommended :

1. Vogel's Text Book of Practical Organic Chemistry (revised): B.S. Furniss, A.J.Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, E.L.B.S., Longman.
2. Systematic Qualitative Organic Analysis : H. Middleton, Orient Longman.
3. A Hand Book of Organic Analysis (Qualitative and Quantitative) : H.T. Clarke, Revised, B.Haynes, Arnold Publishers.
4. The Systematic Identification of Organic Compounds : R.L. Shriner, C. K. F. Harman, T.C. Morrill, D.Y. Curtin, R.C. Fuson, John Wiley and Sons.
5. Organic Analytical Chemistry (Theory and Practice): Jagmohan, Narosa Publishing House.

PG- I

SEMESTER -II

PAPER - VI (CH-1.2.6)

INORGANIC CHEMISTRY

FM -50

Time- 3 hrs.

UNIT- I Metal-Ligand Bonding

Crystal Field Theories :

Limitation of crystal field theory, Elementary idea of Angular overlap model, molecular orbital theory for octahedral, tetrahedral and square planar complexes, σ and π -bonding in molecular orbital theory.

UNIT- II Electronic Spectra and Magnetic Properties of Transition Metal Complexes.

Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1 , d^9 states), calculations of Dq , B and C parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information.

UNIT-III (A) Metal π -Complex.

Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural

elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes, tertiary phosphine and ligands.

(B) Metal Clusters

Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.

Books Recommended :

1. Advanced Inorganic Chemistry : F.A, Cotton and G.Wilkinson, John Wiley.
2. Inorganic Chemistry: J.E. Huheey , E.A. Keiter, R.L. Keiter, Pearson Education.
3. Chemistry of the Elements: N.N.B. Greenwood and A.Earnshaw, Pergamon.
4. Inorganic Electronic Spectroscopy : A.B. P. Lever, Elsevier.
5. Magnetochemistry, R.L. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.

PAPER - VII (CH-1.2.7)

ORGANIC CHEMISTRY

FM -50

Time- 3 hrs.

UNIT-I

(A) Aromatic Electrophilic Substitution :

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeier reaction, Gattermann-Koch reaction.

(B) Aromatic Nucleophilic Substitution :

The benzyne and mechanisms. Reactivity-effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.

(C) Free Radical Reactions :

Types of free radical reactions : Free radical substitution, mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity.

Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes

S_N1, S_N2

and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction, free radical rearrangement, Hunsdiecker reaction.

UNIT - II :**(A) Addition to Carbon-Carbon Multiple Bonds :**

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, orientation and reactivity, Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration, Michael reaction. Sharpless asymmetric epoxidation.

(B) Addition to Carbon-Hetero Multiple Bonds :

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction.

Mechanism of condensation reactions involving enolates, Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

(C) Elimination Reactions :

The E2, E1 and E1cB mechanisms. Orientation of the double bond. Reactivity : Effects of substrate structures,

attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.

UNIT -III Pericyclic Reactions :

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions, conrotatory and disrotatory motions; $4n$, $4n+2$ and allyl systems. Cycloadditions, antarafacial and suprafacial additions; $4n$ and $4n+2$ systems, $2+2$ addition of ketenes. 1,3-dipolar cycloaddition and cheletropic reactions.

Sigmatropic rearrangements - suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5-sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

Books Recommended :

1. Advanced Organic Chemistry; Reactions, Mechanism and Structure : Jerry March, John Wiley.
2. Advanced Organic Chemistry : F.A. Carey and R.J. Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry : Peter Sykes, Longman/Pearson Education.

4. Structure and Mechanism in Organic Chemistry : C. K. Ingold, Cornell University Press.
5. Organic Chemistry : R.T. Morrison and R.N Boyd, Pentice-Hall/ Pearson Education.
6. Modern Organic Reactions : H.O. House, Benjamin.
7. Principles of Organic Synthesis : R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional/ C.B.S. Publishers.
8. Pericyclic Reactions : S.M. Mukherji, Macmillan , India Ltd.
9. Reaction Mechanism in Organic Chemistry : S. M. Mukherjee and S.P. Singh, Macmillan, India, Ltd.
10. Organic Chemistry : J. Clyden, N. Grievess, S. Warren and P.Wother, Oxford University Press.
11. Organic Reactions and Orbital Symmetry : T.L. Gilchrist and R. C. Storr, Cambridge at the University Press.
12. Photo Chemistry and Pericyclic Reactions : Jagdamba Singh and Jaya Singh, New Age International.
13. Mechanism and Theory in Organic Chemistry : Thomas H. Lowry, Addition Wesley.

PAPER - VIII (CH-1.2.8)**PHYSICAL CHEMISTRY****FM -50****Time- 3 hrs.****UNIT-I Chemical Dynamics :**

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory,

Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions.

Dynamics chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen - bromine and hydrogen - chlorine reactions) and oscillatory reactions (Belousov-Zhabotinski reaction), homogeneous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of barrierless chemical reactions in solution, dynamics of unimolecular reactions (Lindemann- Hinshelwood and Rice Rampsberger - Kassel Marcus (RRKM) theories of unimolecular reactions).

UNIT- II Surface Chemistry :**(A) Adsorption :**

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation). Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electrokinetic phenomenon), catalytic activity at surfaces.

(B) Micelles :

Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants counter ion binding to micelles, thermodynamics of micellization, phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

(C) Macromolecules :

Polymers - definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization.

Molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

UNIT-III Electrochemistry :

Electrochemistry of solutions. Debye-Hückel - Onsager treatment and its extension, ion solvent interactions. Debye-Hückel-Jerrum model. Thermodynamics of

electrified interface equations. Derivation of electrocapillarity, Lippmann equations (surface excess), methods of determination, Structure of electrified interfaces,

Over potentials, exchange current density, derivation of Butler -Volmer equation, Tafel plot.

Quantum aspects of charge transfer at electrode - solution interfaces, quantization of charge transfer, tunneling. semiconductor, interfaces-theory of double layer at semiconductor - electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface.

Electrocatalysis-influence of various parameters, Hydrogen electrode.

Bioelectrochemistry, threshold membrane phenomena, Nernst-Planck equation, Hodgkin-Huxley equations, core conductor models, electrocardiography. Polarography theory, Ilkovic equation; half wave potential and its significance.

Books Recommended :

1. Physical Chemistry : P.W. Atkins, J.D. Paula, Oxford University Press.

- Introduction to Quantum Chemistry : A.K. Chandra, Tata Mc Graw Hill.
- Quantum Chemistry : Ira N. Levine, Prentice Hall.
- Coulson's Valence : R. Mc Weeny, ELBS.
- Chemical Kinetics : K.J.Laidler, Mcgraw -Hill
- Kinetics and Mechanism of Chemical Transformations : J. Rajaraman and J.Kuriacose, Mc millan.
- Micelles, Theoretical and Applied Aspects : V. Moroi, Plenum.
- Modern Electrochemistry : Vol.-I and Vol. II J.O.M. Bockris and A.K. N. Reddy, Plenum.
- Introduction to Polymer Science : V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
- An Introduction To electrochemistry : S. Glasstone, Affiliated East-west Press Pvt. Ltd.

PAPER - IX (CH-1.2.9)**INORGANIC CHEMISTRY PRACTICAL****FM -50****Time- 6 hrs.**

- Separation and determination of two metal ions etc. involving volumetric and gravimetric methods.
- Preparation of some selected inorganic compounds and their study. Handling of air and moisture sensitive compounds.

- $\text{Mn}(\text{acac})_3$
- $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
- $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$
- $[\text{Ni}(\text{dmg})_2]$
- $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$
- Cis - and Trans $[\text{Co}(\text{en})_2\text{Cl}_2]$

Books Recommended :

- Inorganic Experiments : J. Derck Woollins, VCH.
- Microscale Inorganic Chemistry : Z. Szafran, R.M. Pike and M.M. Singh, Wiley.
- Practical Inorganic Chemistry : G. Marr and B.W. Rockett, van Nostrand.

 $\text{Ni} - \text{Zn}, \text{Cu} - \text{Fe}$ **PAPER-X (CH-1.2.10)****ORGANIC CHEMISTRY PRACTICAL****FM -50****Time- 6 hrs.****Quantitative Analysis :**

- Determination of amino group by acetylation method.
- Determination of hydroxyl group by acetylation method.
- Estimation of Keto group.
- Determination of iodine value and saponification value of an oil sample.
- Organic Synthesis : Preparation of adipic acid, p-chlorotoluene, p-nitroaniline, p-bromoaniline, triphenylmethanol.

Books Recommended :

1. A Text Book of Practical Organic Chemistry : Arthur I. Vogel, E.L.B.S. and Longman.
2. Vogel's Text Book of Practical Organic Chemistry : Revised, B.S. Furniss, A. J. Hannaford, P.G. Smith and A.R. Tatchell, Longman.
3. Experiments and Techniques in Organic Chemistry : D. Pasto, C. Johnson.
4. Organic Analytical Chemistry (Theory and Practice) : Jagmohan, Narosa Publishing House.
5. Laboratory Manual of Organic Chemistry : B.B. Dey and M.V. Siaram (Revised) : T.R. Govindachari, Allied Publishers.

