

**SEMESTER-I**  
**M 1 IC 01-CT 01**  
**Inorganic Chemistry**

**Time: 3 Hrs.**

**M.M. 80 marks**

**Credits: 4**

**Unit-I**

**Corrosion:** Introduction to corrosion problem, principle of corrosion, types, mechanism of electrochemical corrosion, factors influencing corrosion, thermodynamic considerations and electrode kinetics, special types of corrosion-soil, pit, atmospheric, stray and current corrosion.

**Corrosion testing methods:** Prevention methods based on changing properties of materials, change in environment and minimizing or stopping the corrosion current.

**Unit-II**

**Lubricants:** Introduction, Classification and Functions of lubricants, Mechanism of lubrication, Types of lubricants-solid, semi-solid, liquid and synthetic lubricants, Lubricating oil properties.

**Unit-III**

**Extraction of Metal:** Major and minor constituents of ores, methods of sampling and dissolution of ores, analysis of copper, lead, zinc, silver, iron, manganese and tungsten.

**Unit-IV**

**Homogeneous catalysis:** Study of some important homogeneous reactions catalyzed by transition metal and their complexes.

- (i) Catalytic addition of molecules to C-C multiple bonds, hydrogenation of unsaturated compounds.
- (ii) Carbonylation Reactions – Methanol to acetic acid, methyl acetate to acetic anhydride, adipic ester synthesis.
- (iii) Oxidation reaction- Oxidative carbonylation, palladium catalysed oxidation of ethane, acrylonitrile synthesis, oxalic acid synthesis,
- (iv) Polymerisation, oligomerisation and metathesis reaction of alkenes, alkynes, Ziegler-Natta polymerization of ethylene and propylene.

**Unit-V**

**Heterogeneous catalysis:** Study of some important heterogeneous reactions catalyzed by transition metals and their compounds.

- (i) Reduction of carbon monoxide
- (ii) Hydrogenation of nitro compounds
- (iii) Synthesis of ammonia

**SEMESTER-I**  
**M 1 IC 02-CT 02**

**Organic Chemistry**

**Time: 3 Hrs.**

**M.M. 80 marks**

**Credits: 4**

**Unit-I**

**Reaction mechanism:**  $\sigma$  and  $\pi$  bond, kinetic and thermodynamic control of reaction, transition state and intermediates, methods of determining reaction mechanism, isotope effect, effect of reactivity, linear free energy relationship (Taft and hammett equation).

**Unit-II**

**Introduction of following types mechanism:** Type of reaction – Addition (nucleophilic, electrophilic, free radical), Substitution (nucleophilic, electrophilic, free radical), Elimination and rearrangement reaction.

**Unit-III**

**Name reactions:** Hoffmann-loffler-fretag reaction, Chichibabin reaction, Sharpless asymmetric reaction, Barton reaction, Aldol, Perkin, Stobbe, Dieckman condensation, Michael addition, Mannich reaction.

**Unit-IV**

**Disconnection approach:** Elementary idea of disconnection, an introduction to synthesis, synthetic equivalents, functional group one and two group (C-X and C-C disconnection), Interconversions, chemoselectivity, Diels-alder reaction, 1,3 and 1,5 difunctionalised compounds,  $\alpha,\beta$  unsaturated carbonyl compounds, Michal reaction, robinson annelation.

**Unit-V**

**Pericyclic reaction:** Selection rules and stereochemistry of electrocyclic reaction, cycloaddition and sigmatropic shifts, Sommet-hauser, cope and claisen rearrangements, structural elucidation of organic compounds.

**SEMESTER-I**  
**M 1 IC 03-CT 03**

**Physical Chemistry**

**Time: 3 Hrs.**

**M.M. 80 marks**

**Credits : 4**

**Unit-I**

**Chemical kinetics:** Different methods to determine rate of reaction, factors affecting rate, half life time, order of reaction, entropy and activation energy of reaction and determination, idea of chain conservation, parallel and opposite reactions, oscillation reaction, kinetic salt effect and solvent effect on rate.

**Unit-II**

**Thermodynamics:** thermodynamic systems, laws of thermodynamics and their applications, concept of work, entropy, internal energy, free energy, spontaneous energy, heat engine efficiency, gibb's-helmholtz equation, clausius-clapeyron equation and their uses, chemical potential and uses, heat capacity –  $C_p$  and  $C_v$ .

**Unit-III**

**Electrochemistry:** Standard electrode potential, EMF measurement, different types of electrodes, electrolysis, conductometric and potentiometric titration, pH concept, polarization, overvoltage, decomposition potential storage cells, fuel cells, electrochemical cells and notations.

**Unit-IV**

**Thermochemistry:** Thermochemical reactions, laws of thermochemistry, Kirchhoff's equation, standard heat of formation, combustion, heat of reaction and their related mathematical problems.

**Unit-V**

**Surface chemistry:** Chemical and physical adsorption, adsorption isotherms, Freundlich-langmuir adsorption isotherms, reactions on solid surface, industrial uses of adsorption.

**SEMESTER-I**  
**M 1 IC 04-CT 04**  
**Spectroscopy in Analysis-I**

**Time: 3 Hrs.**

**M.M. 80 marks**

**Credits: 4**

**Unit-I**

**Ultraviolet and visible spectroscopy:** Electronic transition , instrumentation, shift of bands with solvents, the isolated double bond , conjugated dienes , effects of geometrical isomerism ( steric effects, effects of alkyl substitution and ring residue), exocyclic double bonds, woodward-feiser rule, effect of strain around the diene, chromophore, polyenes, UV spectra of carbonyl compounds, unsaturated aldehyde and ketones, UV spectroscopy

**Unit-II**

**Atomic absorption spectroscopy:** Principle, instrumentation and application.

**Unit-III**

**Flame Photometry:** Principle, instrumentation and application

**Photoelectron spectroscopy:** Frank-codon principle, type of electron spectroscopy, ESCA-theory, instrumentation and application, Auger emission spectroscopy- theory , instrumentation and applications.

**Unit-IV**

**IR spectroscopy:** Molecular vibrations, calculation of vibrational frequencies, instrumentation, finger print region, IR of alkanes and effect of some functional groups, effects of hydrogen bonding, Fermi resonance, overtones, shifting of bands due to inductive and mesomeric effects, aromatic and heteroaromatic compounds, effects of ring strain , application of IR spectroscopy, brief idea of FT-IR.

**Unit-V**

**Raman spectroscopy:** Theory, stokes and anti stokes line, Raman depolarization ratio, instrumentation, intensity of Raman peaks, applications.

**Microwave spectroscopy:** Theory, selection rules, diatomic molecules as non-rigid rotator, symmetric top molecules, P-Q-R bands, instrumentation, limitations and applications.

**SEMESTER-I**

**M 1 IC 05-CP 01**

(Practical-A-I)

**Credits 4; Time 8h**

**M.M. 100**  
**80 marks (External)**  
**20 marks (Internal)**

**Organic synthesis** (Yield, Crystallization, M.P. determination, IR characterization)

1. Preparation of m-dinitrobenzene from nitrobenzene
2. Preparation of m-nitroaniline from m-dinitrobenzene
3. Preparation of methyl orange
4. Synthesis p-nitro acetanilide from acetanilide
5. Preparation of 2-iodobenzoic acid from anthranilic acid
6. Thiamine catalyzed Benzoin condensation
7. Synthesis of 2,4 diacetyl-pentanedioic acid diethyl ester
8. Synthesis of 3-methylpyrazol-5-one
9. Synthesis of Benzylidene acetophenone
10. Synthesis of p-bromoacetanilide
11. Synthesis of Urotropine (hexamethylenetetraamine)
12. Synthesis of picric acid
13. Synthesis of oil of winter green

**Organic estimations**

1. Glucose estimation
2. Phenol estimation
3. Aniline estimation

**SEMESTER-I**  
**M 1 IC 06-CP 02**  
(Practical-B-I)

**Credits 4; Time 8h**

**M.M. 100**  
**80 marks (External)**  
**20 marks (Internal)**

**Analysis of Minerals/Ores/Alloys**

1. Determination of CaO & MgO, Al<sub>2</sub>O<sub>3</sub> and Silica in supplied mixture - 2
2. Analysis of Brass (Cu & Zn contents)/ Solder(Sn & Pb contents) - 2
3. Analysis of Wood's Metals Bi/Cd/Pb – 2

**Water analysis**

1. Total hardness of water
2. Alkalinity-OH<sup>-</sup>/CO<sub>3</sub><sup>2-</sup>/OH<sup>-</sup>+HCO<sub>3</sub><sup>-</sup>
3. Chloride contents

**Physical Experiments**

1. Study of first order kinetics
2. Study of second order kinetics
3. Determination of Viscosity