



**DEPARTMENT OF CHEMISTRY,
RABINDRANATH TAGORE UNIVERSITY, HOJAI, ASSAM**

Course Title: Introductory Chemistry

MINOR 3rd SEM

MIN- MIN-CHM-3.2

Total Credit: 4 (3 credit Theory + 1 credit Practical)

Distribution of marks: 70 (End Semester) (45T + 25P) + 15 (In-semester) + 15 (HA/S/GD)

Course objective: The objective of this course is to provide introductory ideas on inorganic polymers, structure and stability of metal complexes, in depth knowledge of the mechanism of nucleophilic substitutions, alcohols and phenols, phase equilibrium and surface chemistry.

Theory: 3 credits

Total course hour: 45 hr

Duration of examination: 2 hr

Unit 1: Inorganic Polymers

(5L, 8 Marks)

Types of Inorganic polymers, Comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes, Borazines, Silicates and Phosphazenes and polysulphates.

Unit 2: Stability and Bonding aspects of Metal Complexes

(10L, 12 Marks)

Crystal Field Stabilization Energy, Octahedral versus tetrahedral coordination, trigonal distortions from octahedral geometry. Jahn-Teller theorem, square planar geometry. Qualitative aspects of ligand field and Molecular orbital theory. Chelate effect. Lability and inertness.

Unit 3: Chemistry of Alkyl and Aryl Halides-II

(7L, 10 Marks)

Stereochemistry of S_N^1 , S_N^2 , S_Ni mechanisms, nucleophilic aromatic substitution via $SNAr$ involving benzyne (elimination–addition) and Meisenheimer (addition–elimination) pathways, introductory transition metal-catalyzed couplings (Suzuki, Heck), synthetic applications.

Unit 4: Alcohols, Phenols, and Ethers-II

(8L, 10 Marks)

Alcohols: Advanced oxidation methods including Swern, Dess–Martin, and TEMPO-mediated oxidations; selective reductions using LAH and $NaBH_4$.

Phenols: Substituent effects on electrophilic aromatic substitution; detailed mechanisms of Reimer–Tiemann, Houben–Hoesch, and Lederer–Manasse reactions; significance of phenol derivatives in chemical and pharmaceutical applications.

Ethers: Limitations of Williamson ether synthesis; acid-catalyzed cleavage of ethers; synthesis and regioselective nucleophilic ring-opening of epoxides.

Concept of phases, components and degree of freedom, Gibbs Phase Rule, Clausius-Claperyon equation and its application to solid liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component system (Water and Sulphur System) and two component system (Bi-Cd system) with applications.

Unit 6: Catalysis and Surface Chemistry

(7L, 10 marks)

Surface Chemistry and Catalysis: Adsorption, Physical and chemical adsorption, adsorption isotherms, Freundlich, Langmuir and BET adsorption isotherms, Introduction to catalyst and Catalysis, homogeneous and heterogeneous Catalysis. Enzyme Catalysis.

Practical: 1 credit

Total course hour: 30 hr

Duration of examination: 3 hr

List of experiments:

1. Separation of organic mixture using solvent extraction (for example benzoic acid and aniline mixture).
2. Separation of organic compounds using sublimation techniques (for example, camphor, naphthalene, benzoic acid).
3. Detection of adulterants in food using organic reactions (for example metanil yellow, vanaspathi in ghee)
4. Preparation of benzanilide from nitrobenzene.
5. Iodine catalyzed decomposition of hydrogen peroxide
6. Acid catalyzed hydrolysis of Ethyl acetate
7. To construct the phase diagram for a partially miscible liquid pair (for example phenol-water system).
8. Estimation of Fe (II) by potassium dichromate solution using diphenylamine indicator.
9. Inorganic Preparation
 - a. Tetramminecarbonatocobalt (III) ion
 - b. Potassium tris (oxalate) ferrate (III)

Learning outcome:

After completion of this course the students will be able to know about inorganic polymers, structure of metal complexes, substitution reaction mechanism involving alkyl and aryl halides, important reactions involving alcohols, phenols and ethers, phase equilibrium and surface chemistry.

1. Vogel's Text Book of Practical Organic Chemistry, 5th Ed., PEARSON.
2. Comprehensive Practical Organic Chemistry: Qualitative Analysis by V. K. Ahluwalia and Sunita Dhingra.
3. Advanced Practical Physical Chemistry by J. B. Yadav.
4. A Text Book of Practical Chemistry by Sudarshan Barua.