

CHEM-107 & CHEM-108 chemistry II ORGANIC CHEMISTRY Credit Hours: 3 (2+1)

Introduction of the course:

Theory

The course is organized to provide an adequate knowledge about basic concepts in organic chemistry including chemistry of hydrocarbons and different functional groups.

Course Objectives:

The course is designed:

1. To introduce students about the key introductory concepts of organic chemistry
2. To introduce about hydrocarbons and different functional groups.

Contents:

1. Basic concept in Organic Chemistry

Localized and Delocalized bonding, conjugation and hyperconjugation; applications, resonance, resonance energy, rules of resonance, resonance hybrid, factor effecting the resonance, inductive effect and applications, steric effect and its applications, hydrogen bonding and its effect on various properties of organic compounds, tautomerism.

2. Chemistry of Hydrocarbons

Preparation of alkanes from coupling alkyl halide and alkyl boranes, corey house synthesis, Free radical reactions of alkenes with halogens with mechanism, comparison of reactivities of halogens.

Preparations of alkenes from Pyrolytic elimination reactions. Relative stability and reactivity of alkenes in terms of Hoffmann and Sytzeff rules, reaction of alkenes i.e.g simon-smith and Diels- Alder reactions.

Preparation of alkynes by alkylation of terminal alkynes, reaction of alkynes; hydroboration and hydration and formation of metal acetylides with mechanism.

Aromaticity, criteria for aromaticity, poly aromatic hydrocarbons like; benzene, naphthalene, anthracene and phenantharene, their resonance structures and relative stabilities, synthesis of naphthalene, orientation and reactivity of naphthalene, electrophilic substitution of naphthalene, oxidation and reduction reaction of naphthalene.

3. Chemistry of Functional Groups

Alcohols: preparation of alcohols by reduction of carbonyl compounds, reaction of alcohol with metals, organic and inorganic acid, oxidation, difference between primary secondary and tertiary alcohols.

Phenols: synthesis of phenols, physical properties, reactions like; carbonation, formylation and diazo coupling

Ethers: preparation of ethers from alcohols, alkyl halides and alkenes, physical properties, reactions of ethers.

Carboxylic acids: Physical properties of acids, effect of various parameters on the strength of aliphatic and aromatic acids, chemical properties like: nucleophilic acyl substitution, decarboxylation, Hunsdicker reaction, substitution at α - carbon.

Acetoacetic and malonic ester synthesis.

Alkyl Halides: Preparation of alkyl halides from carboxylic acids, Nucleophilic substitution (SN1 & SN2) and elimination reactions (E1 & E2) of alkyl halides, effect of various parameters on rate of substitution and elimination reactions.

Practicals:

1) Compound Analysis

Identification of organic compounds containing only one functional group with special emphasis on compounds containing following functional groups.

-COOH, -OH, C=O, -NH₂, and -CONH₂

2) Basic Experimental techniques used in organic chemistry

- Filtration
- Simple and fractional distillation
- Solvent extraction
- Sublimation
- Re-crystallization

3) Estimations (volumetric)

- Determination of molecular weight of a carboxylic acid.
- Estimation of glucose.

Teaching-learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Learning Outcome:

1. Students are expected to get familiarized with the basic concepts of organic chemistry.
2. They will learn about the fundamentals of hydrocarbons and different functional groups.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Recommended Readings:

1. C.K. Ingold, "Structure and mechanism in organic chemistry", C.B.S.
2. I.L.Finar, "Organic Chemistry", Vol. I, Pearson Education, L.P.E.
3. I.L.Finar, "Organic Chemistry", Vol. II, 5th Edition, L.P.E.
4. Jerry March, "Advanced Organic Chemistry, Reaction, Mechanism and Structure", 5th Edition, Wiley Inter Science.
5. Morrison and Boyd, "Organic Chemistry", 6th Edition, Prentice Hall.
6. Seyhan N. Ege, "Organic Chemistry Structure and Reactivity", 3rd Edition, The University of Michigan, A.I.T.B.S. Publishers & Distributors (Regd.).
7. Thomas H. Lowry, Kathleen Schueller Richardson "Mechanism and Theory in Organic Chemistry", 3rd Edition, Harper and Row Publishers, New York.
8. Alder, Baker, Brown, "Mechanism in Organic Chemistry", Wiley Publishers.
9. Atkins Carey, "Organic Chemistry", A Brief Course, 2nd Edition.
10. Peter Sykes, "A guide book to mechanism in organic chemistry", 6th Edition, Pearson Education, Singapore.
