

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

1. Name of the Academic Unit: Chemistry

2. Subject Name: Basic Concepts of Organic Chemistry L-T-P:3-1-0 Credits: 4

3. Pre-requisites: None

4. Syllabus and reference books:

Syllabus:

IUPAC nomenclature of Organic Compounds: (4 Lectures)

- Alkanes: straight-chain alkanes, branched-chain alkanes, Cycloalkanes nomenclature (Polycyclic) Priority rules for determining the parent chain, Locants (numbering) for substituents Alphabetical order for multiple substituents
- Alkenes and Alkynes: Naming alkenes, Naming alkynes, E/Z (cis-trans) isomerism in alkenes, naming systems ene, diene, triene, etc.
- Aromatic Compounds: Naming monocyclic, polycyclic aromatic compounds, numbering pattern,
- Functional Groups: Alcohols, Aldehydes, Ketones, Carboxylic acids, Esters, Amides, Amines, Ethers, Halides, Prioritization of functional groups
- Cyclic Compounds: Fused and Bridged cyclic compounds, polycyclic and Spiro Compounds
- Heterocyclic Compounds: Naming heterocycles containing nitrogen, oxygen, sulfur, etc.
- Complex Structures: Naming natural products (terpenes, steroids, etc.) Naming complex synthetic compounds

Isomerism in Organic Compounds (10 Lectures)

- Structural Isomerism: Chain, position, functional, tautomerism, metamerism, ring-chain isomerism
- Geometrical Isomerism: Significance of chirality in living systems (brief discussion)
- 3-D Structure of Organic Compounds: Concept of chirality and molecular structure (basic symmetry elements Sigma -plane and inversion center);
- Representations in 2D and 3D forms
- Absolute configuration and CIP nomenclature (case studies)
- Molecules devoid of point chirality (allenes and biphenyls brief discussion)

Conformational analysis (10 Lectures)

- Definition and implication); Dihedral angle, torsional angle and strain);
- Few acyclic systems (Gauche-butane interactions);
- Few monocyclic and bicyclic systems and its conformational aspects (Cyclopropane to Cyclooctanes, decalins, diamond lattice)
- Conformations cycloalkenes: mono-enes, dienes (conjugated and isolated) up to cyclooctadienes.
- A(1,3) strain, A(1,2) strain

Basics of writing reaction mechanism (4 Lectures)

- General Structure of a reaction, what to write on the arrow, Order of addition
- Curly arrow notation
- Basics of molecular orbitals: sigma/pi bonding and antibonding, non-bonding orbitals, sigma hole, FMOs.
- Different types of reactions and curly arrow pushing: Polar, Radical and Pericyclic reactions with examples: Transesterification, Radical halogenation of alkanes, Polar and radical hydrohalogenation, halogenation of alkenes, Appel reaction with CBr₄, Diels Alder reaction, Cope Rearrangement, Oxy-Cope Rearrangement, and Aza-Cope Rearrangement (with iminium ion).

Nucleophilic Substitution Reaction (6 Lectures)

- Nucleophilic Substitution reaction at saturated carbon (S_N2/S_N1 and S_Ni reaction)
- NGP in detail
- Stereochemical implication of S_N reactions
- Initial Strategies towards the Synthesis of New Chemical Entities

Elimination reaction: (6 Lectures)

- E1, E2 and E1CB elimination mechanism
- Stereochemical implication
- Syn 1,2-elimination reactions (Cope and related reactions with examples)

Reference Books:

- 1) "Organic Chemistry" by Jonathan Clayden, Nick Greeves, and Stuart Warren
- 2) "Organic Chemistry" by Paula Yurkanis Bruice
- 3) "The Art of Writing Reasonable Organic Reaction Mechanisms" by R. B. Grossman

5. Lecture-wise break-up:

Sl. No.	Topic	No. of lectures
1.	IUPAC nomenclature of Organic Compounds	4
2.	Isomerism in Organic Compounds	10
3.	Conformational analysis	10
4.	Basics of writing reaction mechanism	4
5.	Nucleophilic Substitution Reaction	6
6.	Elimination reaction	6
Total number of hours		40