

**Course Objectives:**

To provide the fundamental knowledge on organic chemistry in order to comprehend other organic chemistry courses in coming semesters with greater depth. The purpose of this core paper is to review the basic concepts of electron displacement and the chemistry of aliphatic and aromatic hydrocarbons. Stereochemistry is also introduced to help to student to visualize the organic molecules and their spatial arrangement in three dimensional spaces and hands on experience on detection of organic molecules.

**Course Outcomes :**

1. Understanding the basic concepts of electronic displacement phenomena in organic molecules, various bond breaking processes and types of organic reactions.
2. Fundamental knowledge on symmetry and asymmetry aspect of organic molecules and their spatial arrangements in two-dimension and three-dimension with their stereochemistry.
3. Learning the synthesis, structure and stability of unsaturated hydrocarbons, understanding the concept of aromaticity and chemical reactions of unsaturated hydrocarbons and aromatic hydrocarbons.
4. Knowledge on selection of suitable solvent for purification and separation of organic compounds and detection of various elements present in it.

**Unit-I: Basics of Organic Chemistry**

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications in dipole moment; organic acids and bases; their relative strength. Homolytic and heterolytic fission with suitable examples. Curly arrow rules; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and relative stability of carbocations, carbanions, free radicals and carbenes.

Introduction to types of organic reactions with suitable examples: Addition, Elimination, Substitution, Rearrangement and Pericyclic reactions.

Carbon-carbon sigma bonds, chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Corey-House Reactions, Free radical substitutions: Halogenation –relative reactivity and selectivity.

**Unit-II: Stereochemistry**

Concept of Chirality/Asymmetry, Geometrical isomerism and Optical Isomerism: Optical Activity, Specific Rotation. Determination of Relative and absolute configuration in chiral molecules using D/L, R/S, cis/trans, Syn/Anti and E/Z descriptors using C.I.P rules. Representation by Fischer Projection, Newmann and Sawhorse Projection formulae in molecules containing one and two chiral-centres. Enantiomers, Distereoisomers, meso-structures, Racemic mixture and their resolution.

Stability and Conformational analysis: types of cycloalkanes and their relative stability, Baeyer strain theory, Conformational analysis of alkanes (ethane and n-butane): Relative stability with energy diagrams. Energy diagrams of cyclohexane: Chair, Half chair, boat and twist boat forms.

### Unit–III: Chemistry of Unsaturated Hydrocarbons

Carbon-Carbon Pi Bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/AntiMarkownikoff addition), mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, syn and anti-hydroxylation (oxidation). 1,2- and 1,4-addition reactions in conjugated dienes and Diels-Alder reaction; Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

### Unit–IV: Chemistry of Aromatic Hydrocarbons

Aromaticity: Hückel's rule, aromaticity in benzenoid and non-benzenoid compounds, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples.

Electrophilic aromatic substitution with mechanism: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the functional groups.

### List of Experiments

1. Detection of extra elements (N, Cl, Br, I and S) in organic compounds by Lassaigne's test.
2. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid groups in known organic compounds.
3. Separation and purification of any one component of following binary solid mixture (Benzoic acid/*p*-Toluidine; *p*-Nitrobenzoic acid/*p*-Aminobenzoic acid; *p*-Nitrotoluene/*p*-Anisidine) based on the solubility in common laboratory reagents/solvents like water (cold, hot), ethanol (cold, hot), dil. HCl, dil. NaOH, dil. NaHCO<sub>3</sub> etc.
4. Determination of melting point and boiling point of different organic compounds

### Text Books:

- ✓ *R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee, Organic Chemistry, 7<sup>th</sup> Ed., Pearson Education India, 2010.*
- ✓ *A. Bahl, B. S. Bahl, Advanced Organic Chemistry, 5<sup>th</sup> Ed., S. Chand, 2012.*
- ✓ *B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> Ed., Pearson Education India, 2003.*

### Reference Books:

- ✓ *T. W. Graham Solomons, C. G. Fryhle, S. A. Snyder, Solomons' Organic Chemistry, Global Ed., Wiley, 2024.*
- ✓ *J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2<sup>nd</sup> Ed., Oxford Publisher, 2012.*
- ✓ *R. K. Bansal, Organic Reaction Mechanism, 3<sup>rd</sup> Ed., Tata McGraw-Hill Publications, 1998.*
- ✓ *D. Nasipuri, Stereochemistry of Organic compounds, 4<sup>th</sup> Ed., New Age International Publisher, 2020.*
- ✓ *P. Sykes, A Guidebook to Mechanism in Organic Chemistry, 6<sup>th</sup> Ed., Pearson Education, 2003.*
- ✓ *F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part-A and Part-B, 5<sup>th</sup> Ed., Springer 2007.*
- ✓ *N. K. Vishnoi, Advanced Practical Organic Chemistry, 3<sup>rd</sup> Ed., Vikas Publishing House, 2009.*
- ✓ *O. P. Agarwal, Advanced Practical Organic Chemistry, Krishna Prakashan, 2014.*
- ✓ *V. K. Ahluwalia, R. Aggarwal, Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, Universities Press, 2004.*
- ✓ *H. T. Clarke, A Handbook of Organic Analysis: Qualitative and Quantitative, 4<sup>th</sup> Ed., CBS Publishers, 2021.*