

Approval: 8th Senate Meeting

Course Name: Fundamentals of Organic Chemistry

Course Number: CY541

Credits: 3-0-0-3

Prerequisites: B.Sc. (with Chemistry) or Teachers consent

Intended for: UG/PG

Distribution: Elective

Semester: Odd/Even

Course Preamble: The objective of this course is to develop basic understanding among students on chemical structure and transformation of organic molecules and also to develop critical thinking skills. The course will provide an overview of the fundamental concepts of electronic structure, molecular arrangements, substitution effects, stereochemistry and common organic reactions. Students will be provided with in-depth information on the above areas.

Course Modules:

Unit 1: Structure and Bonding [10 Lectures]

Review of basic principles of structure and bonding, application of acid base concepts, HSAB theory, aromaticity and antiaromaticity, Hückel's rule, anti-aromaticity, γ -aromaticity, homo-aromaticity n-annulenes, heteroannulene, fullerenes, C-60, cryptates, Bonds weaker than covalent; addition compounds, inclusion compounds, crown ethers, cyclodextrins, catenanes and rotaxanes.

Unit 2: Stereochemistry [12 Lectures]

Conformational analysis of alkanes and cycloalkanes, effect of conformation on reactivity. Elements of symmetry, chirality, molecules with more than one chiral center, projection formulae (i) Fischer (ii) Sawhorse (iii) Newman (iv) Flying Wedge; threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon. Axis and planar chirality. Absolute configuration of chiral centers.

Unit 3: Reaction mechanism [12 Lectures]

Structure and Reactivity: Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, Hammond postulate, Curtin-Hammett principle, transition states and intermediates, methods of determining mechanisms, isotopic effects. Generation, structure, stability and reactivity

of carbocations, carbanions, free radicals, carbenes and nitrenes. Effect of structure on reactivity. The Hammett equation and linear free energy relationship (σ - ρ) relationship, Taft equation

Unit 4: Oxidation, Reduction and Rearrangements [8 Lectures]

Oxidation: Different oxidative processes. Hydrocarbons, carbonyl compounds, amines, hydrazines and sulphides.

Reduction: Different reductive processes. Hydrocarbons, carbonyl compounds, nitro, nitroso, azo and oxime groups. Hydrogenolysis.

Rearrangements: General mechanistic considerations, nature of migration, migratory aptitude, nucleophilic, electrophilic and free radical rearrangement. A detailed study of various arrangements reactions.

Text Books:

1. *Advanced Organic Chemistry, Part A: Structure and Mechanisms*, F. A. Carey and R. A. Sundberg, , Fifth edition, Springer, New York, 2007
2. *Stereochemistry of Organic Compounds* by D. Nasipuri, Wiley, 1994.
3. *Stereochemistry of Carbon Compounds* by E. J. Eliel, McGraw Hill

Reference:

1. *Stereochemistry*, D. G. Morris, , RSC Tutorial Chemistry Text 1, 2001
2. *Organic Chemistry* by S. H. Pine, McGraw Hill, 1987.
3. *Advanced Organic Chemistry* by J. March, John Wiley & Sons, 1992