

Syllabus

M.Sc. (Chemistry) Programme

(SEMESTER – I)

Organic Chemistry – I
Programme Code- (MSCCH -21)
Course Code – (MSCCH -502)

Block 1 Nature of Bonding in Organic Molecules

Unit 1: Nature of Bonding in Organic Molecules

Delocalized chemical bonding: conjugation, cross-conjugation, resonance, hyper conjugation, tautomerism, Energy levels of π orbitals, Huckel's rule, aromaticity, anti-aromaticity and homo-aromaticity, benzenoid and non-benzenoid aromatic compounds, alternant and non-alternant hydrocarbons. Annulenes. Non-covalent bonding – addition compounds, crown ether complexes, cryptands, inclusion compounds, catenanes, rotaxanes and ionic liquids.

Unit 2: Structure and Reactivity

Types of reaction mechanisms, types of reactions, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammond principle. Reaction coordinate, potential energy diagrams, transition states and intermediates. Methods of determining mechanisms, isotope effects.

Unit 3: Reactive Intermediates

Generation, structure, stability and reactivity of carbocations, carbanions, carbon radicals, singlet and triplet carbenes and nitrenes. Effect of structure on reactivity: resonance and field effects, steric effects and quantitative treatment. The Hammett equation and linear free energy relationships, substituent and reaction constants, Taft equation.

Block 2: Stereochemistry

Unit 4: Stereochemistry 1

Stereogenicity, chirality and prochirality, Enantiomerism, Diastereomerism and meso isomerism and racemic modification. Configuration and conformation. Stereochemical descriptors: D, L; R, S; E, Z; syn, anti, etc. Axial, planar and helical chirality. Stereoprojections – Fischer, Sawhorse,

Newman and wedge projections and their interconversions. Absolute and relative configurations and their determination; molecules with one, two or more chiral centres. Simple chemical correlation of configurations with examples, quasiracemates. Stereochemistry and configurations of allenes, spiranes, alkylidene cycloalkanes, adamantanes, catenanes, biphenyls (atropisomerism), bridged biphenyls, ansa compounds and cyclophanes.

Unit 5: Stereochemistry 2

Topicity and prochirality: Topicity of ligands and faces and their nomenclature. Cram's, and Prelog's. Stereoselectivity and stereospecificity and enantiomeric diastereomeric excess, Asymmetric induction. Configuration, conformation and stability of cyclohexanes, cyclohexene (mono and disubstituted), cyclohexanones, halocyclohexanones, decalins. Qualitative correlation between conformation and reactivity, Stereochemistry of Compounds having P, N and S.

Book Suggested:

1. Carey, F.A. & Sundberg, R. J. *Advanced Organic Chemistry*, Parts A & B, Plenum: U.S. (2007).
2. Eliel, E.L. *Stereochemistry of Carbon Compounds* Textbook Publishers (2003).
3. Finar, I. L. *Organic Chemistry* Vol. 1, Longman (1998).
4. Lowry, T. H. & Richardson, K.S. *Mechanism and Theory in Organic Chemistry* Addison – Wesley Educational Publishers, Inc. (1981).
5. Nasipuri, D. N. *Stereochemistry of Organic Compounds: Principles & Applications* South Asia Books (1994).
6. March, J. *Advanced Organic Chemistry* John Wiley & Sons (2004).
7. Kalsi, P.S. *Stereochemistry: Conformation and Mechanism*, 7th Edition New Age International, Delhi (2008).
8. Sengupta.