10. Metz, C. R. *Physical Chemistry 2nd Ed.,* Tata McGraw-Hill

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**Module I**

**Nature of Bonding in Organic Molecules:**

Delocalised chemical bonding conjugation, cross conjugation, resonance, hyperconjugation, bonding in fullerenes, tautomerism.

Armaticity in benzenoid and nonbenzenoid compounds, alternant and non-alternant hydrocarbons.

Huckels rule, energy level of π- molecular orbitals, annulenes, antiaromaticity, Ψ-aromaticity, homo-aromaticity, PMO approach.

Bonds weaker than covalent, addition compounds, crown ether complexes and cryptands, inclusion compounds (cyclodextrins, catenanes and rotaxanes).

**Module II**

**Stereochemistry:**

Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding.

Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution.

Optical purity, enantiotropic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis.

Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape.

**Module III**

**Reaction Mechanism-I (Structure, Reactivity and Rearrangements):**

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

Types of mechanisms: $S_N2$, $S_N1$, mixed $S_N1$ and $S_N2$ and SET, $S_E1$.

Kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle, potential energy diagrams, transition states and intermediates.

Methods of determining reaction mechanisms, isotope effects.

Hard and soft acids and bases concept and its application in organic synthesis.

Effect of structure on reactivity: resonance and field effects, steric effect.

Quantitative treatment, Hammet equation and linear free energy relationships, substituent and reaction constants, Taft equation.

The NGP mechanism, NGP by π and σ bonds, anchimeric assistance.

Classical and nonclassical carbocations, phenonium ions, norbornyl systems, common carbocation rearrangements.

The $S_N1$ mechanism, SN at an allylic, aliphatic trigonal and a vinyl carbon.

Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultra sound, ambient nucleophile and regioselectivity.

**Selected Text/Reference Books:**

1. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Michael B. Smith, Jerry March, Sixth Edition, John Wiley & Sons, Inc.

2. Advanced Organic Chemistry Part A: Structure and Mechanisms, **Carey**, Francis A., **Sundberg**, Richard J, Fifth Edition, Springer International Edition.

3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Sixth Edition, John Wiley & Sons, Inc., New York.

4. Structure and mechanism in organic chemistry, von C. K. Ingold. Cornell Univ. Press, Ithaca. 1953

5. Organic Chemistry, R. T. Moririson and R. N. Boyd, Sixth Edtion, Prentice-Hall

6. Modern Organic Reactions, H. O. House. Benjamin.
7. Principles of Organic Synthesis, R. O. C. Norman and J.M.Coxon, Third Edition, Blackie Academic and Professional
8. *Pericyclic Reactions*: A Mechanistic Study.*S. M. Mukherji Macmillan India* Press, New Delhi
9. Reaction Mechanism in Organic Chemistry, S. M. Mukherjii and S. P. Singh, Third Edition Macmillan *India* Press, New Delhi
10. Stereochemistry of Organic Compounds. D. Nasipuri,Third Edition, New Age International.
11. Stereochemistry of Organic Compounds. P.S.Kalsi, Sixth Edition, New Age International.
12. Organic Synthesis: Clayden J., Greeves N, Warren S, and Wouthers, Second Edition Oxford University Press,