

CHE408 ORGANIC CHEMISTRY

Credits: 4

COURSE OUTCOMES

- CO1:** Explain the principles of photochemical reactions, including energy transfer, excited states, and the pathways of excited molecules, and apply these concepts to organic photochemistry.
- CO2:** Analyze and predict photochemical reactions of carbonyl compounds, including Norrish Type I & II reactions and Paterno-Büchi cycloadditions, with appropriate representation of excited states.
- CO3:** Utilize common reagents such as HATU, LDA, DDQ, DIBAL-H, and NaBH₃(CN) for specific synthetic transformations and strategic planning in organic synthesis.
- CO4:** Demonstrate a comprehensive understanding of key name reactions and mechanisms, including Baker-Venkataraman, Reformatsky, Mannich, Dieckmann, Perkin, Stobbe condensation, Jones oxidation, Vilsmeier-Haack, Benzoin condensation, and Sonogashira coupling.
- CO5:** Apply systematic nomenclature of heterocycles, using the Hantzsch-Widman system, to monocyclic, fused, and bridged heterocycles.
- CO6:** Understand the synthesis, chemical behavior, and applications of five-membered aromatic heterocycles and their benzo-fused derivatives, such as oxazole, isoxazole, thiazole, pyrazole, imidazole, benzothiazole, and benzimidazole.
- CO7:** Explore the synthesis, reactivity, and applications of six-membered heterocycles and their benzo-fused analogs, including pyrazine, pyridazine, pyrimidine, cinnoline, quinazoline, quinoxaline, and phenoxaline.
- CO8:** Integrate theoretical and practical knowledge of photochemistry and heterocyclic chemistry to solve complex problems in organic synthesis and reaction mechanisms.

Unit 1 Photochemistry

- **Photochemical reactions:** Principles of energy transfer, electronic excitation and molecular orbital view of excitation, excited states and excitation and molecular orbital view of excitation, excited states, and fate of excited molecules (modified Jablonski diagram), Photosensitization.
- **Photochemistry of carbonyl compounds:** Representation of excited states of ketones, photo reduction Norrish type I & II reactions, Reactions of cyclic Ketone, oxetane formation (Paterno-Buchi reaction)
- Di-π methane rearrangement, Dienone photochemistry, cis-trans isomerisation and photochemistry of conjugated olefins.

Unit 2 Inorganic Reagents in Organic Reactions

- Gilman's reagent-Lithium dimethylcuprate
- Lithium diisopropylamide (LDA)
- Dicyclohexyl carbodiimide (DCC)
- 1,3 – Dithiane (Umpolung reagent)
- Dess- Martin periodinane
- Diisobutylaluminium hydride (DIBAL –H)
- Sodium cyanoborohydride (NaBH₃(CN))
- DDQ

- *n*-Butyl lithium
- Grignard reagents
- **Phase transfer catalysis:**
 - Quaternary ammonium and phosphonium salts
 - Crown ethers

Unit 3 Common Name Reactions and Their Applications

Reactions, Mechanism and Applications of the following name reactions:

- Baker Venkataraman reaction
- Reformatsky reaction
- Mannich reaction
- Dieckmann reaction,
- Perkin Reaction,
- Stobbe condensation,
- Jones oxidation
- Vilsmeier-Haack reaction
- Benzoin Condensation
- Sonogashira coupling

Unit 4 Heterocyclic Compounds

- **Nomenclature of heterocycles:**
 - Few examples of systematic nomenclature (*Hantzsch-Widman* system) for monocyclic, fused and bridged heterocycles.
- **General chemical behaviour of following aromatic heterocycles and their synthesis and important applications. (Three examples each)**
 - **Five-membered and benzo fused five member heterocycles:**
 - ❖ *Oxazole, Isoxazole, Thiazole, Pyrazole, Imidazole, Benzothiazole and Benzimidazole.*
 - **Six membered and benzo fused six membered heterocycles:**
 - ❖ *Pyrazine, Pyridazine, Pyrimidine, Cinnoline, Quinazoline, Quinoxaline, Phenoxaline.*

Reference Books

1. Advanced Organic Chemistry, Reactions Mechanisms and Structure, J. March, 6th Edition, John Wiley.
2. Carbenes, nitrenes and arynes, T.L. Gilchrist and C.W. Rees.
3. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh
4. Organic Chemistry; Morrison, R. N. & Boyd, R. N.; Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Organic Chemistry (Volume 1); Finar, I. L.; Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
6. A Text Book of Organic Chemistry; ArunBahl, S and B.S. Bahl; Sultan Chand & Sons, New Delhi.
7. Organic Chemistry Second Edition – Mehta and Mehta; PHI Learning Pvt. Ltd.