

ACHARYA NAGARJUNA UNIVERSITY

DEPARTMENT OF CHEMISTRY

M.Sc. ORGANIC CHEMISTRY :: SEMESTER-IV

PAPER-II: ORGANIC SYNTHESIS & REACTION MECHANISMS-II (R22OC42)

(For the students admitted from the A.Y. 2022-2023 onwards)

Max. Marks: 100

(Internal-30M & External-70M)

SYLLABUS

Learning Objectives:

- ✓ To learn about the basics of C-C single and double bond formations and Diels-Alder reactions.
- ✓ To learn terminology and develop skills in writing retro-synthetic routes for target molecules with one and two functional groups.
- ✓ To learn different approaches in photochemical and pericyclic reactions.
- ✓ To learn terminology and selectivity in asymmetric synthesis and also apply the approaches in organic synthetic reactions.
- ✓ To learn the Nucleophilic additions to chiral carbonyl compounds and Felkin-Anhmodel.

UNIT-I

12H

Formation of C-C Single & Double Bonds and Diels-Alder & Related Reactions:

Formation of C-C single bonds—enamines and related reactions.

Formation of C-C double bonds—Corey-winter olefination, Peterson olefination, Julia olefination, McMurry coupling, Wittig reaction of Phosphorus ylides—stereoselective synthesis of tri and tetra-substituted alkenes.

Diels-Alder and related reactions – diene-dienophile, intramolecular Diels-Alder reactions, Stereochemistry and mechanism Retro Diels-Alder reaction – 1,3-dipolar reactions.

UNIT-II

12H

Synthetic Strategies or Retro Synthetic Analysis: Terminology- Target Molecule(TM), synthon, synthetic equivalent, functional group interconversion (FGI), and representation of disconnection of bonds. Linear and convergent synthesis. One group and two group disconnections in simple molecules- Alcohols, Olefins, aryl ketones, α,β -Unsaturated compounds – 1,3 dicarbonyl compounds. synthesis involving chemoselectivity, regioselectivity, reversal of polarity and cyclizations.

UNIT-III

12H

Photochemistry: Photochemistry of olefins—conjugated olefins—Aromatic compounds— isomerisation—additions. Photochemistry of carbonyl compounds—Norrish type I and II reactions—Paterno-Buchi Reaction. Photo reduction, Photochemical rearrangements—Photo Fries rearrangement, Di- π -methane rearrangement.

UNIT-IV

12H

Pericyclic Reactions: Definition, classification, MO theory, Electronic configuration in ground and first excited states of aliphatic conjugated polyene system (upto 4 double bonds).

Electrocyclic Reactions: Mechanism, stereochemistry, PMO, FMO, correlation diagram, Woodward Hoffman rules. **Cycloaddition Reactions:** FMO and correlation diagram methods- (2+2) and (4+2) cycloaddition reactions, stereochemistry. Woodward Hoffman rules.

Sigmatropic Rearrangement: classification, Mechanism by FMO method, Woodward Hoffman rules. Cope, Claisen and Aza-cope rearrangements.

UNIT-V

12H

Asymmetric Synthesis-II: Substrate Controlled Asymmetric Synthesis: Nucleophilic additions to chiral carbonyl compounds. 1, 2- asymmetric induction, Cram's rule, and Felkin-Anh model. i) Chiral auxiliary controlled asymmetric synthesis: α -Alkylation of chiral Enolates, aza enolates, 1,4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder and Aldol reactions. ii) Chiral reagent controlled asymmetric synthesis: Asymmetric reductions using BINOL-H.; Asymmetric Hydroboration using $(\text{IPC})_2\text{BH}$ and IPCBH_2 .

Reference Books:

- 1) Some Modern methods of synthesis By Caruthers (Cambridge)
- 2) Organic synthesis by Robert & Ireland (Printice Hall of India)
- 3) Designing Organic Synthesis B Stuart Warron, John Wiley & Sons
- 4) "Pericyclic reactions a mechanistic study" S.M. Mukheji
- 5) Synthetic approaches in Organic Chemistry "R.K. Bansal Narosa Publications
- 6) Advances in Organic Chemistry – Reaction mechanism and structure" by J. March (Mc Graw Hill).
- 7) 'Organic Photo chemistry and Pericyclic reactions' M.G. Arora Anmol Publications Pvt. Ltd.
- 8) Fundamentals of photochemistry by K.K. Rohatgi–Mukharjee Now Age international publishers.
- 9) Photochemistry by C W S Wells.
- 10) Organic Photochemistry by Turro.
- 11) Molecular Photo chemistry by Gilbert & Baggo.
- 12) Organic Photo chemistry by D Coyle.
- 13) Asymmetric synthesis by Nogradi.
- 14) Asymmetric organic reactions, J. D. Morrison and H. S. Moscher.
- 15) Principles of Asymmetric synthesis, R. E. Gawley and J. Aube, 2nd Ed., Elsevier, 2012.

Learning Outcomes:

- ✓ Students understand the basics of C-C single and double bond formations and Diels–Alder reactions.
- ✓ Students learnt the terminology and develop skills in writing retro-synthetic routes for target molecules with one and two functional groups.
- ✓ Students learnt different approaches in photochemical and pericyclic reactions
- ✓ Students are able to understand the terminology and able to know selectivity in asymmetric synthesis and also able to apply the approaches in organic synthetic reactions.
- ✓ Students understand the Nucleophilic additions to chiral carbonyl compounds and Felkin-Anh model.



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