

ACHARYA NAGARJUNA UNIVERSITY
DEPARTMENT OF CHEMISTRY
M.Sc. ORGANIC CHEMISTRY :: SEMESTER-III

PAPER-II: ORGANIC SYNTHESIS & REACTION MECHANISMS-I (R22OC32)

(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 tools required for determining reaction mechanisms.
- ✓ To develop simple skills in writing mechanism of organic reactions.
- ✓ To understand different radical reactions involving additions, substitutions, and decompositions and their mechanisms.
- ✓ To learn different approaches and reagents of various oxidation and reduction processes in organic synthesis and also their mechanisms.
- ✓ To learn terminology and selectivity in asymmetric synthesis and also apply the approaches in organic synthetic reactions.

UNIT-I

10H

Methods for Reaction Mechanism by Kinetic & Non-Kinetic studies

Kinetic studies: Kinetics of reaction, Energy profile diagram, Intermediate versus transition state, Reaction rate and rate limiting step.

Non-Kinetic studies Identification of products, testing possible intermediates, trapping of intermediates, Cross over experiments, Isotopic labeling.

UNIT-II

10H

Free Radicals

Free radicals and their reactions-Introduction to radical reactions, Addition of halogens, Hydrogen halides. Substitution reactions- Halogenation, Aromatic substitution, Sandmeyer reaction, Autooxidation, Decomposition of dialkyl and diacyl peroxides.

UNIT-III

14H

Oxidations

Introduction: Different Oxidative processes.

Hydrocarbon: Alkenes, aromatic rings saturated C-H groups (activated and unactivated), Alcohols, diols, aldehydes, Ketones, Carboxylic acids, Amines, hydrazines, sulphides. Oxidations with ruthenium tetroxide iodobenzene diacetate and TI(III) nitrate, Lead tetra acetate, SeO₂, MnO₂ Ag₂CO₃, peracids.

Oxidation of C=C perhydroxylation using KMnO₄, OsO₄, peracids.

UNIT-IV

14H

Reductions

Introduction: Reductive process Hydrocarbons: Alkanes, alkenes, alkynes, and aromatic rings

Carbonyl compounds-aldehydes, ketones, acids and their derivatives. Nitro, nitroso, azo and oxime group Hydrogenolysis. Catalytic hydrogenations, Reduction by dissolving metals, Reduction with metal and acid. Reduction with metal in liquid ammonia (Birch reduction).

Reduction by hydride transfer reagents Aluminium alkoxide, LiAlH₄, NaBH₄, Diisobutyl aluminium hydrides-Sodium cyano borohydride, tryalkyl borohydrides-Reduction with diimide.

Asymmetric Synthesis-I

Terminology: Topocity in molecules Homotopic, stereo Heterotopic (enantiotopic and diastereotopic) groups and faces- symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re, and Si.

Selectivity in synthesis: Stereo specific reactions (substrate stereoselectivity). Conditions Stereo selective reactions (product stereoselectivity): Enantio selectivity and diastereoselectivity.:

Analytical Methods: % Enantiomer excess, optical purity, % diastereomeric excess.

Reference Books:

- 1) Mechanism and structure in Organic Chemistry “ E.S.Could Henry – Holt and Co, Newyork.
- 2) Advances in Organic Reaction mechanism and structure J. March (McGrew Hill).
- 3) Aguide Book to Mechanism in Organic Chemistry” by P.Sykes.
- 4) Synthetic approaches in organic chemistry by R.K.Bansal (Narosa Publications).
- 5) Some modern methods of synthesis by Carruthers (Cambridge).
- 6) Asymmetric synthesis by Nogradi.
- 7) Asymmetric organic reactions by it) Morrison and HS Moschr.
- 8) Stereo differentiating reactions by Izumi.

Learning Outcomes:

- ✓ Students can understand the fundamental tools required for the determination of reaction mechanisms.
- ✓ Students can able to apply the reagents and approaches for various synthetic reactions involving oxidations and reductions
- ✓ The knowledge on asymmetric synthesis provides a platform for carryout various stereo chemical reactions wherever necessary to apply towards research.
- ✓ Students can understand the reduction by dissolving metals, reduction with metal and acid.
- ✓ Students can understand the terminology, selectivity in synthesis and analytical methods.



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