CH-463 Named Organic Reactions

Credit Hours: 3-0

Prerequisite: Nil

Course Objectives

By the end of this course, students will:

1. Understand the mechanistic foundation of named organic reactions and their synthetic utility.
2. Correlate reaction types with functional group transformations in complex organic synthesis.
3. Interpret the scope, selectivity, and limitations of named reactions in multistep synthesis.
4. Analyze named reactions with respect to stereochemistry, regiochemistry, and chemo-selectivity.
5. Apply named reactions in the retrosynthetic analysis and design of organic compounds including drugs and natural products..

Course Contents

6. Introduction to Named Reactions and Their Classification: Historical perspective and classification: functional group transformations, rearrangements, additions, oxidations/reductions, Importance in synthesis and drug design
7. Name Reactions Involving Carbon–Carbon Bond Formation: Aldol and Claisen condensations, Michael addition and Robinson annulation, Mannich reaction, Wittig and Horner–Wadsworth–Emmons reactions, Stork enamine reaction
8. Rearrangements and Pericyclic Reactions: Beckmann, Hofmann, Curtius, and Baeyer–Villiger rearrangements, Claisen and Cope rearrangements, Diels–Alder reaction and variants, Sigmatropic shifts
9. Substitution and Elimination-Based Name Reactions: Sandmeyer and Balz–Schiemann reactions, Finkelstein and Swarts reactions, E2 and E1 elimination strategies in named contexts, Mitsunobu reaction
10. Oxidation, Reduction and Functional Group Interconversion: Clemmensen, Wolff–Kishner, and Birch reductions, Swern and Dess–Martin oxidations, Oppenauer and Meerwein–Ponndorf–Verley reductions, Pinnick oxidation

11. Metal-Mediated and Catalytic Named Reactions: Grignard, Reformatsky, and Corey–Fuchs reactions, Suzuki, Heck, Stille, and Sonogashira couplings, Sharpless asymmetric epoxidation and dihydroxylation, Buchwald–Hartwig amination
12. Applications in Total Synthesis and Pharmaceutical Chemistry: Strategic use of named reactions in retrosynthesis, Case studies from total synthesis of natural products, Named reactions in the synthesis of APIs (Active Pharmaceutical Ingredients), Reaction optimization and green chemistry considerations

Course Outcomes

After completing this course, students will be able to:

16. Explain the mechanisms and key intermediates involved in classical and modern named reactions.
17. Predict the products and conditions required for named reactions.
18. Evaluate the synthetic applications of named reactions in total synthesis.
19. Design multistep syntheses using appropriate named reactions.
20. Analyze literature examples and real-world applications of named reactions in industrial and medicinal chemistry..

Recommended Books:

21. Strategic Applications of Named Reactions in Organic Synthesis — Laszlo Kürti & Barbara Czakó, Elsevier Academic Press, 2005
22. Name Reactions: A Collection of Detailed Reaction Mechanisms — Jie Jack Li, Springer, 2014 (5th Edition)
23. Modern Organic Synthesis: An Introduction — Michael H. Nantz & George S. Zweifel, W. H. Freeman, 2007
24. March’s Advanced Organic Chemistry: Reactions, Mechanisms, and Structure — Michael B. Smith & Jerry March, Wiley, 2007 (6th Edition)
25. Organic Chemistry — Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press, 2012 (2nd Edition) (Supplementary Reading).