

# CY705 Modern Methods in Organic Synthesis

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Credit: 3-0-0-3

Approval: Approved in 2nd Senate

Elective or core: Elective

Students intended for: MSc and PhD Students

Semester: Odd/Even: Any Semester

Prerequisite: Bachelors degree with Chemistry as one of the Subjects

## Course objective:

An advanced course designed to teach general and modern synthetic methods with special emphasis on reaction mechanisms.

## Course content:

- **Asymmetric Synthesis: (13 hours)** Stereoselective-Directed Aldol Reaction, Diastereofacial selectivity in the Aldol Reaction, Zimmermann-Traxler chair Transition States, Z and E Boron Enolates. Sharpless Asymmetric Dihydroxylation, AD mix Reagents, Jacobsen catalytic asymmetric epoxide-opening reaction, kinetic resolution of epoxides, Shi Asymmetric epoxidation reaction, Asymmetric Diels Alder Reaction, Noyori's Asymmetric Hydrogenation, Enantioselective addition to C=O bonds, Enantioselective synthesis of Cyclopropanes.
- **Reactions involving Organometallics (14 hours)** Lithium-Halogen exchange reactions, Magnesium Halogen exchange reactions, Organo Lithiums: production, stability, storage, titrations, additives, and general reactions. Directed orthometallation reactions, Allyl and Substituted-Allyl Metal Chemistry, Cyclic Closed Transition State, Open Transition State, Cyclic Transition State, Allyl Zincs and Allyl Boron Reagents. Brown's Reagent Preparation and uses, Roush's Chiral Borolane Reagent preparation and uses, Allylsilanes, Allylstannanes, Allyl Titanium Reagents. Yamamoto's Chiral Silver (I) Complex: Trimethoxy Silanes.
- **General Organic Reactions (15 hours)** Suzuki Coupling: Reactions and mechanisms, conditions, catalysts and ligands, synthesis of boronates, sp<sup>3</sup>- sp<sup>3</sup> Suzuki Coupling, strategic application of Suzuki coupling in the synthesis of Discodermolide, Rutamycin B and Epothilone A. Heck Reaction: Reactions and mechanisms, catalyst, regiochemistry, Tandem Heck reactions, enantioselective Heck Reactions. Stille Reaction: Reactions and mechanisms, conditions, synthesis of aryl and vinyl stannanes. Horner-Wadsworth-Emmons Olefination, Peterson's Olefination, Oxidations: Oppenauer Oxidation, Chromium (VI) oxidants, IBX, DMP oxidations, N-Oxoammonium mediated oxidation, Oxidation reactions using o-Iodoxybenzoic acid (IBX), Dess-Martin Periodinane (DMP), Rubottom Oxidation. Reductions: Lithium Aluminium Hydride (LAH), Lithium Borohydride, Borane Complexes Luche reduction, Ionic Hydrogenation, Barton Decarboxylation, Radical Dehydrogenation, Diazene-Mediated Deoxygenation. Wolf Kishner Reduction, Clemmensen Reduction.

## Text & Reference Books:

1. Francis Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part B: Reactions and Synthesis, V edition. Springer 2007
2. Michael B. Smith and Jerry March. March's Advanced Organic Chemistry, 6th Edition, Wiley 2007
3. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford, 2006.
4. Laszlo Kurti and Barbara Czako, Strategic Applications of Named Reactions in Organic Synthesis, Elsevier Academic Press, 2005.
5. Reinhard Bruckner, Advanced Organic Chemistry: Reaction Mechanisms, Elsevier, 2002