Course Outline: Chem 502 Advanced Organic Synthesis

Course Description: Designed to build on the total synthesis concepts introduced in the sophomore-level organic sequence. Reactions of organic compounds will be studied from the perspective of conformational analysis, mechanism, reactive intermediates, and synthetic methods. *Prerequisite: A minimum grade of C (2.0) in CHEM 202L or classified graduate standing.*

Learning Outcomes

- Demonstrate understanding of the basic principles that govern the electronics, structure and bonding in organic compounds and reactive intermediates
- Explore the fundamental and experimental aspects of asymmetric organic transformations
- Apply reactions in the context of catalysis, reactivity, and total synthesis
- Demonstrate and predict the reactivity pattern in organic transformations
- Have a background to apply organic chemistry to other fields: polymerization, bioinorganic chemistry, etc.

Text: Reader will be based on materials from current journals and selected texts, including:

- Modern Organic Synthesis, G. Zweifel and M. Nantz, *Freeman*, 2007.
- Organic Synthesis, M. B. Smith, *Academic Press*, 2011.
- The Art of Writing Reasonable Organic Reaction Mechanisms, R. B. Grossman, *Springer*, 2003.

Other useful references:

- The Logic of Chemical Synthesis, E. J. Corey, X.-M. Cheng, *VCH*, 1995.

Attendance: Attendance is mandatory and essential to do well in the class.

Homework: Seven comprehensive problem sets will be given throughout the semester. The problem sets will emphasize the topics covered during the lecture.

Examination: Two mid-term examinations and one final exam will be given.

Quizzes: Four quizzes are anticipated for the semester. The 10-minute quizzes will be based on readings and class notes since the last quiz. Goals in this course include the ability to discuss important aspects of retrosynthesis and synthetic methods.

Grading: The course will be graded based on the following criteria:

Presentation:	50	(40 points written, 10 points oral)
Problem Sets:	140	(7 problem sets @ 20 points each)
Quizzes:	100	(4 quizzes @ 25 points each)
Participation:	30	
Midterm Examinations:	200	(2 exams @ 100 points each)
Final Examination:	200	
Total Possible Points	720	

Topics

Week 1	Introduction to organic synthesis, terminology, protecting groups
Week 2-3	Oxidation chemistry, including topics on enantioselectivity
Week 4-5	Reduction chemistry, including topics on enantioselectivity
Week 6-7	Olefin synthesis
Week 8-9	Carbon-carbon bond formation reactions, including enolates and aldol
Week 10-11	Organometallics
Week 12-13	Pericyclic reactions, including Diels-Alder, Claisen, Cope, and dipolar
Week 14	Sigmatropic rearrangements
Week 15	Retrosynthesis and total synthesis review

Presentation

Part 1: Oral. Students will choose from a list of named reaction topics to study in more detail and present to the class. Students will choose one journal article that highlights this reaction as a key synthetic step. Paper will be submitted to instructor at least one week prior to the scheduled oral presentation. The paper will be distributed to the class one week before the discussion. Students will prepare 2-3 questions for the class to incorporate into the presentation. Presentation will be a 5-8 minute presentation at the beginning of class.

Part 2: Written. A 5 – 6 page paper (1.5 – double spaced, 12 pt. font, ¾" – 1" margins) is due within one week of the oral presentation. The paper should be written as an introduction to the named reaction and its application as the key synthetic steps of a total synthesis.