Chem. 306 **Advanced Organic Chemistry** Spring 09

3 credits Dr. Griswold

pre-requisite: one year of organic chemistry

class meets: 8-9:15 Tues, Thur, Miller 33

text: Smith and March, *Advanced Organic Chemistry,* 6th ed., Wiley 2006, plus additional handouts.

Grading: 3 in-class examinations (open-book) , 25% each, total 75%
(first two exams have a take-home portion, third exam includes a student presentation of an assigned molecular rearrangement)

final exam (scheduled by Registrar): 25%
If final exam score exceeds the lowest in-class exam score, it substitutes for that score in addition to counting its usual 25%.

In-class Exam dates: Feb. 17, Mar. 24, Apr. 21

Course description: A continuing study of organic chemistry with emphasis on mechanism and structure elucidation, condensation reactions, organometallic applications, multicenter reactions, rearrangements, and theory and reactions involving aromatic systems, and planning an organic multi-step synthesis. A constant reference will be made to spectral verification of structure.

College outcomes: increased technical literacy, scientific reasoning, oral and written communicative skills are all enhanced through this course.

Course objectives and outcomes:
This course is intended mainly for chemistry and biochemistry students who are contemplating research positions and/or graduate study. It is also for students in related fields who anticipate chemical applications in their career work. It is our desire to pursue reactions and phenomena not covered or simply introduced in the basic organic courses, with a focus on synthesis applications, mechanism elucidation, spectral verification of structure, and comparative energies of molecules. We will make constant use of the chemical literature in all topics discussed. It is hoped that the course will give a deeper insight into modern applications of organic chemistry.

Assessment of outcomes: through the in-class examinations, take-home portions, in-class presentations, and final examination.

Attendance and protocols: students are expected to attend all classes. The instructor should be notified if you cannot attend. Students at this level are expected to show overall career-oriented professionalism, which includes consistent attendance and punctuality. Arrive on time for class.

Practice problems: Although the text is a universal and excellent reference with lucid explanations and examples, it does not contain problem sets with each unit. Therefore, a problem set with answers will be provided with each major unit covered. Feel free to consult the instructor for any clarifications or assistance.

Sequence of Topics: *dates of coverage are deliberately omitted. Material to be covered on the examinations and quizzes will be announced in class.*

1. **Introduction:** oxidation state of carbon, synthesis of functional groups, handouts on spectral methods.

2. **survey of reactive carbon species.**
   carbocations, carbanions, radicals, carbenes, nitrenes: stability factors, occurrences, chemical behavior. Other "fugitive intermediates".
   text: Ch.5, pp. 234-295

3. **methods for studying and elucidating mechanisms.**
   reaction types, kinetic vs. thermodynamic control; product identification, trapping of intermediates, crossover experiments, isotopic labeling, kinetic isotope effects, stereochemical implications, Hammett equation.
   text: Ch. 6, pp. 299-305, 311-327

4. **nucleophilic carbon: "active methylene"**,
   enols, enol ethers, enolates; condensations, conjugate additions, cyclizations, alkylations, acylations, use of eneamines.
   text: Ch. 10: pp. 622-635; Ch.16: pp. 1292-1295, 1339-1398, handouts

5. **nucleophilic carbon: organometallic applications.**
   reductions, organoboron survey, organolithiums, Grignard and Reformatsky processes, organocopper reagents, palladium coupling reactions; metallocarbenes.
   text: Ch.15: pp 1075-81, Ch. 16: pp. 1300-1336, handouts.

6. **multicenter reactions.**
   Diels-Alder, Ene reaction, dipolar additions, insertion processes.

   text: Ch. 15: pp 1103-05, 1187-1218, 1233-42

7. **rearrangements.** (students will present individual assigned examples)-
   In acid, base, uncatalyzed. Synthesis applications, mechanism elucidation

   text: Ch.18: pp 1580-1625, 1674-81

(continued……)

8. **aromatic substitutions: electrophilic and nucleophilic**
arynes, resonance contributions, synthesis applications, group directive effects.
text: Ch.11: pp. 657-751, Ch. 13: pp. 853-933

9. **multi-step synthesis:** designing a synthesis, retrosynthesis, protective groups; enantioselective reagents; combinatorial chemistry in drug discovery. *(handouts)*

Throughout the course, references will be made to the chemical literature, and at times students will be asked to retrieve articles or information using our online and hardcopy literature sources.

Office hours: will be announced during first week of classes.
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Welcome to Advanced Organic Chemistry.