CHM 5410 Organic Mechanisms and Synthesis Spring 2007

Course description: This course will introduce and cover important concepts involved with the structure and behavior of organic compounds, as well as detailed examination of standard organic mechanisms.

Prerequisites: CHM 2840 (year-long organic sequence)

Course objectives:

- (1) bring familiarity with resources useful to organic chemists
- (2) bring familiarity to reading organic literature
- (3) emphasize key points in structure, reactivity
- (4) illustrate mechanisms and give further practice in drawing mechanism
- (5) introduce selected key transformations for synthesis
- (6) introduce synthetic planning and retrosynthetic analysis

Course format/details:

Lecture time/place: 2:00 - 2:50 pm MWF Room 4125 PSB

| Instructor: | Dr. Edward Treadwell | Instructor's office: Room 4450 PSB |
|-------------|----------------------|------------------------------------|
| | Phone: 581-6229 | email: <u>cfemt@eiu.edu</u> |

- Office hours: Mon. 12 noon 1 pm, 3 4 pm, Weds. 11 noon, Fri. other hours by appointment gladly considered.
- Textbooks: <u>Advanced Organic Chemistry, Part B</u>, 4th ed. by Carey & Sundberg <u>March's Advanced Organic Chemistry</u>, 5th ed., edited by Smith & March

Books at Reserve desk: <u>Comprehensive Organic Transformations</u>, 2nd ed. by Larock ^(3hr reserve) <u>Advanced Organic Chemistry, Part A: Structure and Mechanisms</u>, 4th ed. by Carey and Sundberg ^(1 day checkout) <u>Classics In Total Synthesis I</u> and <u>Classics in Total Synthesis II</u> by Nicolaou et al ^(3 day) <u>Stereochemistry of Organic Compounds</u> by Eliel et al ^(3 hr reserve) <u>Protecting Groups in Organic Synthesis</u>, 3rd ed. by Greene and Wuts ^(3 hr reserve)

Webpage: <u>http://www.ux1.eiu.edu/~cfemt/5410</u>

Attendance:

Class attendance, including arriving to class on time, and your attention during class is expected. Missing more than five days of class will result in a failing grade. Additionally, class participation is expected and encouraged.

Workload / Grading :

Grades will derived from the following five sources, as shown below:

| 8-12 Homework assignments (~24% of total grade) | 110 |
|--|---------|
| 3 Exams (50 points each) (~33% of total grade) | 150 |
| 2-4 Projects | 50 |
| Drills (~7% of total grade) | 30 |
| 1 Presentation (~8% of total grade) | 40 |
| Final Exam (~17% of total grade) | 80 |
| Total | 460 pts |

The homework assignments will be derived from the material discussed in lecture, and will refer at times to the primary literature. You will have at least a week from when the homework assignment is passed out until it is due. Responses should be written CLEARLY and EASILY READABLE on separate paper.

The three in class exams will *tentatively* be given the <u>week of Feb. 5th, March 5th, and April 16th</u>. Exact dates will be settled upon as the course develops. The final, cumulative exam is on <u>Wednesday May 2, 2005 at 2:45 pm</u></u>. Some exams will have in-class as well as take-home portions.

Once the day of the exam is finalized, you should expect to take the exam on that day at the specified time. I will not be very receptive to providing alternate exam times unless there are EXTREMELY compelling reasons as described in the catalog. If you think you have a compelling reason, it is imperative that you discuss this with me a WEEK before the exam (at the latest) if you expect some accommodation. Requests made within a week of the exam will most likely be denied.

The projects will explore topics / develop proficiencies in areas not specifically covered in the lecture material, and will be individualized for each student. You usually will have at least two weeks to complete each assignment.

Drills refer to in-class participation questions, randomly assigned on Mondays starting the second week of class.

The presentation will be given during the last week of class, describing a synthesis from the recent literature. A guide will be handed out that provides a list of required components.

While you are free to work with others on the **homework** assignments, it is important that you hand in your own work – cases of plagiarism/direct copying will be referred to the Office of Judicial Affairs. Please note that on the take-home portion of **exams**, you must work independently unless otherwise specified!

Schedule of topics:

On the next page are the anticipated topics that will be covered in this course, though some of the topics below may not be covered or substituted for other topics as the course develops. The anticipated topics covered will be followed in the general order shown below, though we may not spend an equal amount of time on each subject.

Section I - Foundations

Structure, Bonding, and Reactivity

Hybridization, bond lengths, angles, energies, electronegativity, resonance March Ch. 1, 2 (omit pp. 47-71)

Valence bond theory, Molecular orbital theory, Frontier molecular orbital theory

Conformational analysis, Steric and electronic effects March Ch 4 pp. 167-191, Ch. 9 up to pg. 368

Acid-Base Chemistry

pK_a's / Acid-strength / Hard-soft Acid-Base theory March Ch. 8

Hammett equation and Linear Free Energy relationships March Ch. 9 pp. 368-375

General versus specific acid catalysis

Thermodynamics and equilibria - equations, Curtin-Hammett postulate, Hammond postulate, Baldwin rules March Ch. 6 up to p. 287, March pp. 381-387

Section II - Reactions

- Enolate Chemistry alkylations, Aldol (Zimmerman transistion state, Evans auxillaries) C&S Ch. 1, 2.1 March pp. 548-556, pp. 1218-1223
- Reductions of / Additions to Carbonyl Compounds Cram, Felkin-Anh models C&S 5.2 March pp. 1197-1203, 1203-1209
- Oxidations Sharpless epoxidation, Sharpless dihydroxylation C&S 12.2, 12.3, March pp. 981-988, 1051-1054
- Pericylic Reactions Woodward-Hoffman rules, Diels-Alder, Cope/oxyCope, 1,3-dipolar, Ene C&S 6.1, 6.2, 6.5, 6.7 March pp. 1062-1075, 1059-1062
- Substitution reactions Anomeric effect, Nonclassical carbocations, Esterification March pp. 404-420, pp. 484-487

Organoboron chemistry

C&S 9.1 Organosilicon chemistry C&S 9.2 Metal-catalyzed reactions - Suzuki, Ring-closing metathesis C&S 8.2, 8.4, 9.3

Section III - Synthesis

Formation of C-C Bonds

Protecting groups C&S 13.1

Retrosynthetic analysis and synthesis C&S 13.2-13.7