

CEM 852: "Methods of Organic Synthesis" — Spring 2011

Course Content:

According to the course catalog, the course content is as follows: "In-depth coverage of the principle reactions leading to carbon-carbon bond formation, along with functional group transformations. Strategies and methods for organic synthesis." We will cover the reactivity, methodology, and mechanistic aspects of the reactions of alkenes and alkynes, oxidations and reductions, enolates and related nucleophiles, pericyclic reactions, transition-metal chemistry, etc.

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Course Secretary: Ms. Nancy Lavrik
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Class Time: T & Th 8:30-9:50 am, room 481E Chemistry Building
& Sat. 10 am – 12 pm, room 581E Chemistry Building

Web-page: <http://www2.chemistry.msu.edu/courses/cem852/index.html>

Required Texts:

1. Paul Wyatt & Stuart Warren, Organic Synthesis: Strategy and Control, Wiley, 2007. ISBN-978-0-471-92963-5
2. George S. Zweifel & Michael H. Nantz, Modern Organic Synthesis: An Introduction, W.H. Freeman, 2007. ISBN-0-7167-7266-3

Recommended Texts:

1. Paul Wyatt & Stuart Warren, Workbook for Organic Synthesis: Strategy and Control, Wiley, 2007. ISBN-978-0-471-92964-2
2. K.C. Nicolaou & E.J. Sorensen, Classics in Total Synthesis, Targets, Strategies, Methods, VCH, 1996. ISBN-3-527-29231-4

Grading Scheme:

<u>Exam/Assignment</u>	<u>pts</u>
Midterm Exam 1	100
Midterm Exam 2	100
Classic Synthesis Presentation	50
Total Synthesis First Oral Report	10
Total Synthesis Final Oral Report	50
Total Synthesis Written Report:	40
<u>Final Exam:</u>	<u>150</u>
Total	600

Tentative Lecture Schedule:

<u>Dates</u>	<u>Subject</u>	<u>Reading</u>
January 11	Course Intro/Review of Physical Data	CEM 850
January 13	Introduction to Retrosynthetic Analysis	Wyatt/Warren Chapter 1
January 18	Design of Experiments (DOE)	–
January 20	Regioselectivity: Controlled Aldol Reactions	Wyatt/Warren Chapter 3
January 25	Stereoselectivity: Stereoselective Aldol Reaction	Wyatt/Warren Chapter 4
January 27	Alternative Strategies for Enone Synthesis	Wyatt/Warren Chapter 5
February 1	The Synthesis of Cyclopentenones	Wyatt/Warren Chapter 5
February 3	The Ortho Strategy for Aromatic Compounds	Wyatt/Warren Chapter 7
February 8	σ -Complexes of Metals	Wyatt/Warren Chapter 8
February 10	Controlling the Michael Reaction	Wyatt/Warren Chapter 9
February 15	Specific Enol Equivalents	Wyatt/Warren Chapter 10
February 17	Review	–
Sat. Feb. 19*	Exam 1, 9 am – noon, room 183 (100 pts)	–
February 22	Extended Enolates	Wyatt/Warren Chapter 11
February 24	Allyl Anions	Wyatt/Warren Chapter 12
March 1	Homoenolates	Wyatt/Warren Chapter 13
March 3	Acyl Anion Equivalents	Wyatt/Warren Chapter 14
March 15	Synthesis of Double Bonds of Defined Stereochemistry	Wyatt/Warren Chapter 15
March 17	Stereocontrolled Vinyl Anion Equivalents	Wyatt/Warren Chapter 16
March 22	Electrophilic Attack on Alkenes	Wyatt/Warren Chapter 17
March 24	Vinyl Cations: Palladium-Catalyzed C–C Coupling	Wyatt/Warren Chapter 18
March 29	Allylic Alcohols: Allyl Cation Equivalents (and More)	Wyatt/Warren Chapter 19
March 31	Review	–
Sat. April 2*	Exam 2, 9 am – noon, room 183 (100 pts)	–
April 5	Controlling Relative Stereochemistry	Wyatt/Warren Chapter 21
April 7	Asymmetric Induction: Reagent-Based Strategy	Wyatt/Warren Chapter 24
April 12	Asymmetric Catalysis: Formation of C–O and C–N Bonds	Wyatt/Warren Chapter 25
April 14	Asymmetric Catalysis: Formation of C–H and C–C Bonds	Wyatt/Warren Chapter 26
April 19	Asymmetric Induction: Substrate-Based Strategy	Wyatt/Warren Chapter 27
April 21	Kinetic Resolution	Wyatt/Warren Chapter 28
April 26	Enzymes: Biological Methods in Asymmetric Synthesis	Wyatt/Warren Chapter 29
April 28	Review	–
Monday May 2	Final Exam, 7:45–10:45 a.m., room TBA (150 pts)	all inclusive

Note: No makeup exams will be given. If you miss an hourly examination due to *religious holidays, unavoidable personal commitments, illness, etc.*, your course grade will be calculated by adding the point value (100 pts) of each missed exam to the Final Exam. (If you know you will have a conflict with the dates indicated above AND you let me know by February 1, I will arrange for a makeup date.)

Supplemental Material:

You may also find Professor Reusch's Virtual Textbook of Organic Chemistry (<http://www.cem.msu.edu/~reusch/VirtualText/title.htm>) and the associated interactive problems and tutorials helpful. Furthermore, please check the announcements link on the 852 web frequently as important information, course up-dates, and additional materials will be placed there as the course progresses.

Classic Syntheses (50 points):

Students will each present a synthesis from Nicolaou's "Classics in Total Synthesis" (on reserve in the BPS library). The presentations will take place on Saturday's beginning at 9 am in room 581E. Plan for your presentation to take about 30 minutes, *excluding* questions. Your lecture will be graded using the same criteria used for the Organic Seminars, including input from your classmates. I also expect you to provide a PDF file within one week of your presentation for placement on the web. (Note: please use white backgrounds for your presentation.)

Schedule

1. January 15	Rapamycin (Chapter 31)	Robert Maleczka
2. January 29	Erythronolide B (Chapter 11)	Damith Perera
3. January 29	Methyl Homosecodaphniphyllate (Chapter 26)	Hao Li
4. February 5	Amphotericin B (Chapter 24)	Benjamin Weaver
5. February 5	Ginkgolide B (Chapter 25)	Rosario Amadosierra
6. February 12	Asteltoxin (Chapter 20)	Luis Mori
7. February 12	Calicheamicin (Chapter 30)	Salinda Wijeratne
8. March 5	Hirsutene (Chapter 23)	Beth Schoen
9. March 5	Progesterone (Chapter 6)	Gregory Spahlinger
10. March 19	Periplanone B (Chapter 13)	Nastaran Salehimarzijarani
11. March 19	Endiandric Acids A–D (Chapter 17)	Jason Clasper
11. March 26	Zaragozic Acid (Chapter 35)	Fangyi Shen
13. March 26	Strychnine (Chapter 33)	Peter Heisler

If you know you of a conflict with the dates indicated above AND you let me know by 1/19 I will arrange a makeup date. Otherwise, if you miss your "Classic Synthesis" presentation, we will pro-rate your final.

Total Synthesis (100 pts):

In March, each of you will be given a natural product for which you are to design a synthesis. We will first meet on April 16th at which time you should plan on presenting a 10 minute retrosynthesis of your molecule highlighting what you view will be the key points of your proposed synthesis. I will expect a hard copies your retrosyntheses at this time. On April 25 we will meet for your full 30 minute (maximum!) presentation. You should bring handouts of your presentation for the entire audience.

A written report describing your synthesis is also part of this assignment. This report should resemble a grant proposal (or journal manuscript) with a strict 10-page limit, including all Schemes but excluding references. Your written report is also due on April 25th. Each synthesis will be graded on the basis of your presentation, how you respond to questions, chemical soundness, creativity, thoroughness, the clarity of your final report, and your attendance. More details on this assignment will be given later in the semester.

Total Synthesis Schedule:

First Oral Report (10 pts): To be presented Saturday April 16 starting at 9 am in room 581E.

Written Report: (40 pts): ALL reports are 7 pm Monday April 25th (2nd drafts handed in after 4/26 will NOT be graded).

Final Oral Report (50 pts): To be presented over three days: Monday April 26, Tuesday April 27, and Wednesday April 28. Tentatively, all presentations will take place in room 581E. The presentation order will be determined at random, so everybody needs to be prepared to present on April 26th.

Class Conduct

Professional, courteous, and ethical conduct is expected of all students at all times. Likewise, diversity among students should be respected. Finally, please turn off your cell phones before entering the class room.

Policy on Cheating

In order to discourage cheating, the instructor may make copies of some pages of some exams. Any student caught cheating will receive a grade of 0.0 for that test. In addition, a letter describing the incident will be sent to the chairperson of the Chemistry department, as well as that student's Department Chair, College Dean, and each member of the student's Ph.D. committee.
