

CEM 852: "Methods of Organic Synthesis" — Spring 2017

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 Coordinator: Ms. Nancy Lavrik
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Class Time: T & Th 8:30-9:50 am, room 111 Biochemistry Building
& Sat. 10 am – 12 pm, room 481E Chemistry Building

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

Required Texts:

Paul Wyatt & Stuart Warren, Organic Synthesis: Strategy and Control, Wiley, 2007. ISBN-978-0-471-92963-5

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 10	Course Intro/Review of Physical Data	–
January 12	Introduction to Retrosynthetic Analysis	Wyatt/Warren Chapter 1
January 18*	Chemoselectivity	Wyatt/Warren Chapter 2
January 19	Overview of Aldol Reactions	Wyatt/Warren Chapter 3
January 24	Regioselectivity: Controlled Aldol Reactions	Wyatt/Warren Chapter 3
January 26	Stereoselectivity: Stereoselective Aldol Reaction	Wyatt/Warren Chapter 4
January 31	Alternative Strategies for Enone Synthesis	Wyatt/Warren Chapter 5
February 1*	The Synthesis of Cyclopentenones	Wyatt/Warren Chapter 6
February 7	The Ortho Strategy for Aromatic Compounds	Wyatt/Warren Chapter 7
February 9	σ -Complexes of Metals	Wyatt/Warren Chapter 8
Sat. Feb. 11	Exam 1, 9 am – noon, room 126 (100 pts)	–
February 14	Controlling the Michael Reaction	Wyatt/Warren Chapter 9
February 16	Specific Enol Equivalents	Wyatt/Warren Chapter 10
February 21	Extended Enolates	Wyatt/Warren Chapter 11
February 23	Allyl Anions	Wyatt/Warren Chapter 12
February 28	Homoenolates	Wyatt/Warren Chapter 13
March 2	Acyl Anion Equivalents	Wyatt/Warren Chapter 14
March 14	Synthesis of Double Bonds of Defined Stereochemistry	Wyatt/Warren Chapter 15
March 16	Stereocontrolled Vinyl Anion Equivalents	Wyatt/Warren Chapter 16
March 21	Electrophilic Attack on Alkenes	Wyatt/Warren Chapter 17
March 23	Palladium-Catalyzed C–C Coupling	Wyatt/Warren Chapter 18
Sat. Mar. 25	Exam 2, 9 am – noon, room 126 (100 pts)	–
March 28	Palladium-Catalyzed C–C Coupling	Wyatt/Warren Chapter 18
March 30	Allylic Alcohols: Allyl Cation Equivalents (and More)	Wyatt/Warren Chapter 19
April 5*	Control of Stereochemistry - Introduction	Wyatt/Warren Chapter 20
April 6	Controlling Relative Stereochemistry	Wyatt/Warren Chapter 21
April 11	Asymmetric Induction: Reagent-Based Strategy	Wyatt/Warren Chapter 24
April 13	Asymmetric Catalysis: Formation of C–O and C–N Bonds	Wyatt/Warren Chapter 25
April 18	Asymmetric Catalysis: Formation of C–H and C–C Bonds	Wyatt/Warren Chapter 26
April 20	Asymmetric Induction: Substrate-Based Strategy	Wyatt/Warren Chapter 27
April 25	Kinetic Resolution	Wyatt/Warren Chapter 28
April 27	Enzymes: Biological Methods in Asymmetric Synthesis	Wyatt/Warren Chapter 29
Wed. May 3	Final Exam, room and time TBD (150 pts)	all inclusive

*These lectures will be held Wednesday evening at 7 pm in room 581W.

Note: No makeup exams will be given. If you miss an hourly examination due to *religious holidays, unavoidable personal commitments, grief absences, 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 January 17, I will arrange for a makeup date.)

Supplemental Material:

You may also find Professor Reusch's Virtual Textbook of Organic Chemistry (<http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm#contnt>) 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 10 am in room 481E. 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 by the Tuesday following your presentation for placement on the web. (Note: please use white backgrounds for your presentation.)

Schedule

1. January 21	Rapamycin (Chapter 31)	Robert Maleczka
2. January 28	Strychnine (Chapter 2)	Kio Tanemura
3. January 28	Methyl Homosecodaphniphyllate (Chapter 26)	Yuting Zhou
4. February 25	Erythronolide B (Chapter 11)	Ryan Fornwald
5. February 25	Asteltoxin (Chapter 20)	Monique Noel
6. February 25	Monensin (Chapter 12)	Zibin Tan
7. March 4	Monensin (Chapter 15)	Katrina Keel
8. March 4	Amphotericin B (Chapter 24)	Dhwani Kansal
9. March 4	Zaragozic Acid (Chapter 35)	Soham Maity
10. March 11	Cytovaricin (Chapter 28)	Seokjoo Lee
11. March 11	Taxol (Chapter 34)	Jose Montero
12. March 11	Periplanone B (Chapter 13)	Md Shafaat Al Mehedi
13. April 8	Endiandric Acids A–D (Chapter 17)	Mengxia Sun
14. April 8	Hirsutene (Chapter 23)	Mehdi Moemeni

If you know you of a conflict with the dates indicated above AND you let me know by 1/17 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 at 10 am on Saturday April 15 in room 581W. At that meeting you will be expected to present a 10-minute retrosynthesis of your molecule highlighting what you view will be the key points of your proposed synthesis, including the means by which your synthesis will be made asymmetric. I will expect a hard copies your retrosyntheses at this time. On the evenings of April 24–26 we will meet at 7 pm in room 581W for a full presentation of your synthesis (30 minutes maximum!). Again, you need to bring me a hard copy of your presentation.

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 at 7 pm on April 24th. 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 15 starting at 10 am in room 581W.

Written Report: (40 pts): ALL reports are due at 7 pm Monday April 24th (2nd drafts handed in after 4/24 will NOT be graded).

Final Oral Report (50 pts): To be presented over three evenings: Monday April 24, Tuesday April 25, and Wednesday April 26, starting at 7 pm each night (581W). The presentation order will be determined at random, so everybody needs to be prepared to present at 7 pm on April 24th.

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 classroom.

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.
