

# CHM 6225 Advanced Principles of Organic Chemistry - Syllabus

## (Physical Organic Chemistry)

Spring 6225-3550, Tuesday, Thursday, 11:45 am – 1:40 pm, Leigh Hall 104  
Professor Stephen A. Miller, miller@chem.ufl.edu, Office Leigh Hall 318A

**Course Description.** Principles of organic chemistry and their application to reaction mechanisms. A detailed introduction to the theory and principles of organic chemistry; bonding and structure in organic chemistry, stereochemistry, reactive intermediates in organic chemistry and transition state theory; kinetics and thermodynamic approaches. Exploration of these concepts via computational chemistry will also be emphasized. Prerequisites: CHM 2210, 2211 (or one year of undergraduate organic chemistry) and CHM 5224.

**Syllabus.** The syllabus below is subject to change. Updated versions and reading assignments will be available on E-Learning (see below). The chapters refer to the principal textbook for the course, *Advanced Organic Chemistry: Part A: Structure and Mechanism, Fifth Edition*. Additional course reading from *Stereochemistry of Organic Compounds (SOC)* and *Mechanism and Theory in Organic Chemistry, Third Edition (MTOC)* will be made available.

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Class #1	January 5	Class Introduction/Overview. 1.1 Molecular Structure and Valence Bond Concepts
Class #2	January 7	1.2 Molecular Orbital Theory and Methods
Class #3	January 12	T1.1, T1.2, T1.3, Bonding Topics
Class #4	January 14	2.1 Configuration
Class #5	January 19	SOC 4.1–4.6 Symmetry, Point Groups
Class #6	January 21	2.2–2.3 Conformation, Molecular Mechanics <a href="#">PS#1 DUE</a>
Class #7	January 26	2.4–2.6, T2.1, T2.2, T2.3 Stereochemistry of Reactions, Stereoelectronic Effects
Class #8	January 28	3.1, MTOC 2.3 Thermodynamic Stability, Benson Group Additivities <a href="#">PS #2 DUE</a>
Class #9	February 2	<a href="#">Midterm Exam I</a> (Chapters 1–3.1)

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Class #10	February 4	3.2 Chemical Kinetics
Class #11	February 9	3.3 Thermodynamic Stability and Reaction Rates
Class #12	February 11	3.4–3.5 Electronic Substituent Effects, Isotope Effects
Class #13	February 16	3.6 Linear Free-Energy Relationships
Class #14	February 18	3.7–3.8 Catalysis, Solvent Effects
Class #15	February 23	4.1 Mechanisms for Nucleophilic Substitution <a href="#">PS #3 DUE</a>
Class #16	February 25	4.2–4.3 Structural and Solvation Effects, Neighboring-Group Effects
Class #17	March 2	4.4, T4.1 Carbocations, Carbocations in Petroleum Processing <a href="#">PS #4 DUE</a>
Class #18	March 4	<a href="#">Midterm Examination II</a> (Chapters 3.2–4)

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	March 9	No Class. Spring Break
	March 11	No Class. Spring Break
Class #19	March 16	5.1–5.9 Addition Reactions
Class #20	March 18	5.10 Elimination Reactions
Class #21	March 23	6.1–6.5, T3.1 MTOC 3.3–3.4 Hydrocarbon Acidity, Carbanions and Carbon Nucleophiles
Class #22	March 25	7.1–7.7 Carbonyl Compounds <a href="#">PS #5 DUE</a>
Class #23	March 30	8.1–8.6 Aromaticity
Class #24	April 1	9.1–9.5 Aromatic Substitution <a href="#">PS #6 DUE</a>
Class #25	April 6	<a href="#">Midterm Examination III</a> (Chapters 5–9)

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Class #26	April 8	10.1–10.6 Concerted Pericyclic Reactions
Class #27	April 13	11.1–11.2 Generation and Characterization of Free Radicals, Mechanisms
Class #28	April 15	11.3–11.6 Reactions Involving Radicals
Class #29	April 20	12.1–12.4 Photochemistry, Photochemical Reactions <a href="#">PS #7 DUE</a>
Final Exam	April 27	<a href="#">Final Exam</a> (Chapters 1–12) Tuesday, April 27th, 7:30 am – 9:30 am, LEI 104

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### Required Textbook:

1) Carey, F. A.; Sundberg, R. J. *Advanced Organic Chemistry: Part A: Structure and Mechanism, Fifth Edition*; Springer: New York, 2007 (ISBN 978-0-387-68346-1, Paperback, Amazon.com, \$38.68).

### Required Software:

1) **Spartan, Student Edition** (for Macintosh or Windows). *Wavefunction*. wavefun.com (\$50)

[http://wavefun.com/products/macintosh/Student/mac\\_student.html](http://wavefun.com/products/macintosh/Student/mac_student.html)

[http://wavefun.com/products/windows/Student/win\\_student.html](http://wavefun.com/products/windows/Student/win_student.html)

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**Recommended Textbooks:**

- 1) Carey, F. A.; Sundberg, R. J. *Advanced Organic Chemistry: Part B: Reactions and Synthesis, Fifth Edition*; Springer: New York, **2007** (ISBN 978-0-387-68354-6, Paperback).
- 2) **SOC** = Eliel, E. L.; Wilen, S. H.; Mander, L. N. *Stereochemistry of Organic Compounds*; Wiley-Interscience, New York, **1994** (ISBN 0-471-01670-5).
- 3) **MTOC** = Lowry, T. H.; Richardson, K. S. *Mechanism and Theory in Organic Chemistry, Third Edition*; HarperCollins Publishers: New York, **1987** (ISBN 0-06-044084-8).
- 4) Smith, M. B.; March, J. *March's Advanced Organic Chemistry, Fifth Edition*; Wiley-Interscience: New York, **2001** (ISBN 0-471-58589-0).
- 5) Carroll, F. A. *Perspectives on Structure and Mechanism in Organic Chemistry*; Brooks/Cole, Pacific Grove, CA, **1998** (ISBN 0-534-24948-5).
- 6) Anslyn, E. V.; Dougherty, D. A. *Modern Physical Organic Chemistry*; University Science Books, Sausalito, CA, **2006** (ISBN 1-891389-31-9).

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**E-Learning Website.** All students will have access to the E-Learning website: <https://elearning.courses.ufl.edu/webct>

You will login with your Gatorlink account username and password. This is where you will find general class information, important news, office hours, handouts, class notes, and keys. This is also where you will be able to find out your point totals and histograms.

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**Class Requirements.**

- 1) Seven problem sets (35 points each; 210 points max; the lowest score will be dropped)
- 2) Ten in-class quizzes (10 points each = 100 points total)
- 3) Three midterm examinations (150 points each = 450 total)
- 4) Final examination (240 points)

**= 1000 points total**

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**Problem Sets.** Problem sets will be **due at 5:00 pm** on the designated due dates. They can be turned in after class or into the in/out box outside of Leigh 318A (on the file cabinet). Answer keys will be posted at this time. Please write only on the paper provided. The problem sets *may* be spot-graded; this means that only some or parts of the problems may be scored and contribute to the 35 points. The lowest of the seven scores must be dropped. You may work in groups or alone. But you may not copy answers. The problem sets are designed to prepare you for the examinations.

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**In-Class Quizzes.** You are expected to read the assigned chapter sections before each class. The ten in-class quizzes, which will be unannounced and randomly distributed during the semester, will be short and are designed to encourage you to attend class and to keep up with the course. They should be fairly easy for those who have read the assigned material. Quizzes can only be taken during the class period in which they are administered. They cannot be made up without an official, written University excuse. Each quiz will be worth 10 points.

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**Midterm Examinations.** There will be three midterm examinations and each will focus on the chapters designated. The midterms are not designed to be cumulative; but you may expect some natural amount of material from a previous midterm to be important and necessary.

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**Final Examination.** The final examination will be cumulative. The best way to study for it will be to keep up during the semester and review all notes and assignments for the course. Working problems—frequently and consistently—may be the best overall approach to mastering the course material.

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**Extra Credit.** Opportunities *may* arise for extra credit (e.g., extensive class participation, attending a lecture outside of class, or an extra credit question on an exam). In any event, no more than 50 extra credit points may be earned. Extra credit will be applied after the curve is assigned for the course. This may allow some students to raise their grade by a maximum of one letter grade.

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**Grading.** Grades will be curved based on points earned out of 1000. The extra-credit will then be added to those who have earned it to determine if an increase in the final grade is achieved.

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**Teaching Assistant.** Matt Burnstein is scheduled to be the teaching assistant for this course. He can usually be found in Sisler 113 or 119 or he can be reached at 392-9741 or by email at [mattieb@ufl.edu](mailto:mattieb@ufl.edu).

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**Assignment Regrading.** If you have a question concerning the grading of an assignment, you may submit the entire assignment for complete regrading. The assignment must be submitted for regrading by the second class meeting after the date the assignment was returned to the class.

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**Online Notes Templates** will be available at E-Learning (see above) in pdf format. They are organized by book chapter. The templates are made and posted to help you follow the lecture; hopefully this will allow you to spend less time writing and more time thinking. Students are encouraged to print the note templates and bring them to class to facilitate notetaking. Except for Chapter 1, they will not be available in class.

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**Office Hours.** Office hours will be posted on the E-Learning Website. They will likely be held in Leigh Hall 328 (the Polymer Conference Room). Additional/individual office hours should be possible and should be scheduled by email.

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**Makeup Examinations.** Makeup examinations will be given only for University-excused absences provided the appropriate documentation is supplied within the allowed timeframe. Please inform me of an absence ahead of time whenever possible.

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**Attendance.** Attendance for this class is not recorded. However, the ten unannounced and random in-class quizzes will generally reflect your attendance pattern.

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**Class Numbers.** To facilitate the grading and return of assignments, I request that you write your name and class number on each one. The class numbers will be assigned after a few classes.

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**Important Dates.** April 9<sup>th</sup> is Drop Day.

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**Accommodations for students with disabilities.** Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

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**UF Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.**

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On all work submitted for credit by students at the university, the following pledge is either required or implied: **"On my honor, I have neither given nor received unauthorized aid in doing this assignment."** "The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior."

**Cheating and Plagiarism.** Cheating and/or plagiarism will not be tolerated. The minimum penalty will be an automatic zero on the assignment in question. A reduction of the final course grade is also likely. Suspension from the University may also result. Do not risk it. It is not worth it. Plagiarism consists of passing off as one's own the ideas, words, writings, etc. that belong to someone else. You are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have that person's permission. See:

<http://www.registrar.ufl.edu/catalog/policies/students.html>

<http://www.dso.ufl.edu/sccr/honorcode.php>

<http://www.dso.ufl.edu/studentguide/studentrights.php>

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