Syllabus for Chemistry 316 - Spring 2024

Instructor: Prof. Yuwei Gu
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Location: CCB 1303 (same as Chem 315)
Time: Monday/Wednesday 2:00–3:20 pm
Office hours: **After-Class Office Hours:** Monday/Wednesday 3:20–4:00 pm (CCB 3105)
End-of-Week Office Hours: Friday 1:00–2:00 pm (CCB 3105)
Textbooks: Clayden, Greeves, & Warren: Organic Chemistry 2e (same as Chem 315)

Recitation: Prof. Heinz Roth (Office hours: time and location TBA)
Prof. Kiranjot Sethi (Office hours: time and location TBA)

Chem 316 and Chem 315 are intimately connected. Chem 315 equips you with the tools necessary to understand most organic reactions. It is not an exaggeration to say that Chem 316 is essentially just a practice of using these tools. You will find yourselves at an immediate loss if you enter the Chem 316 classroom without refreshing your understanding of concepts covered in Chem 315, such as resonance/conjugation, molecular orbitals, aromaticity, pKa values, nucleophilicity/electrophilicity, stereochemistry, energy landscapes, thermodynamic/kinetic products, Curtin-Hammett Principle, microscopic reversibility, Hammond Postulate, conformational analysis, NMR, nucleophilic addition to carbonyl groups, SN1/SN2/E1/E2, to name a few. Make sure you are familiar with all these concepts.

Lectures: Lecture attendance is mandatory, so please arrive early. We will start promptly. If you have a conflict – which should be rare – be sure to notify Professor Gu to obtain his approval beforehand. In case of an emergency, please inform him as soon as reasonably possible.

Recitation: Recitation attendance is mandatory. Recitation is designed to allow students to ask questions, converse with an expert in the field, and review material. It is particularly useful for addressing challenging practice problems. **Professor Roth** is a world-renowned chemist with deep insight into molecular structure, mechanism, and spectroscopy. He loves the material, possesses a delightful and lighthearted sense of humor, and nothing makes him happier than a sincere question. **Professor Sethi** has been heavily engaged in teaching at Rutgers for over a decade and has extensive experience in teaching organic chemistry courses. She is passionate about the teaching-discovery-learning process and is an organic chemistry student-favorite.

Lecture notes: **Lecture notes will be posted on Canvas three days in advance.** The intentional blank spaces within these notes serve as a canvas for your active engagement. During lectures, Professor Gu will frequently embellish these notes with annotations—drawing structures, explaining reaction outcomes, and summarizing key concepts. You are expected to draw these structures along with Professor Gu during the lectures, as a solid grasp of organic chemistry often emerges through extensive drawings of molecular structures. **Therefore, it is recommended to print the lecture notes before class for convenient note-taking. Alternatively, for a paperless approach, ensure access to an electronic copy on your annotation devices during lectures.** A final, fully annotated version of the lecture notes by Professor Gu will be posted within one day after each session.

Homework: There is no graded homework, but practice problems will be posted on Canvas after each chapter. These problems aim to help students practice applying the concepts taught in class to solve questions in a manner similar to what will be tested in the exams. Selected practice problems will be discussed in recitations.

Model kits: Molecular models are required. **<u>One of the most important yet underestimated aspects of organic chemistry is the need to develop an understanding of three-dimensional relationships involving orbitals, atomic arrangements, molecular shapes, and symmetries.</u>** In Chem 316, we will frequently apply the concept of conformational analysis (covered in Chem 315) to rationalize and predict the steric/stereoelectronic outcomes of organic reactions. Despite the availability of computer software (e.g., Chem3D) for three-dimensional visualization of molecules, hand-held molecular models are still the most effective means to learn these intricate spatial relationships in a truly meaningful and tangible way.

Schedule: Please note that, except for the fixed mid-term exam dates, the chapter-by-chapter schedule is subject to adjustment and change without further notification.

Chemistry 316 Spring 2024 Course Schedule			
01/17 (Wed.)	Lecture 1	Electrophilic Addition to Alkenes	Chapter 19
01/22 (Mon.)	Lecture 2	Electrophilic Addition to Alkenes	Chapter 19
01/24 (Wed.)	Lecture 3	Electrophilic Aromatic Substitution	Chapter 21
01/29 (Mon.)	Lecture 4	Electrophilic Aromatic Substitution	Chapter 21
01/31 (Wed.)	Lecture 5	Electrophilic Alkene & Nucleophilic Aromatic Substitution	Chapter 22
02/05 (Mon.)	Lecture 6	Electrophilic Alkene & Nucleophilic Aromatic Substitution	Chapter 22
02/07 (Wed.)	Lecture 7	Review for Exam 1	
02/12 (Mon.)	*Exam 1 (Lecture 1 to Lecture 7)*		
02/14 (Wed.)	Lecture 8	Special Topic on NMR	Chapter 18 & 31
02/19 (Mon.)	Lecture 9	Exam 1 Discussion/Alkylation of Enolates	Chapter 20 & 25
02/21 (Wed.)	Lecture 10	Alkylation of Enolates	Chapter 25
02/26 (Mon.)	Lecture 11	Aldol Reaction	Chapter 26
02/28 (Wed.)	Lecture 12	Aldol Reaction	Chapter 26
03/04 (Mon.)	Lecture 13	Acylation of Enolates	Chapter 26
03/06 (Wed.)	Lecture 14	Review for Exam 2	
03/11 (Mon.)	Spring Break		
03/13 (Wed.)	Spring Break		
03/18 (Mon.)	*Exam 2 (Lecture 8 to Lecture 14)*		
03/20 (Wed.)	Lecture 15	Pericyclic Reactions	Chapter 34
03/25 (Mon.)	Lecture 16	Exam 2 Discussion/Pericyclic Reactions	Chapter 34 & 35
03/27 (Wed.)	Lecture 17	Pericyclic Reactions	Chapter 35
04/01 (Mon.)	Lecture 18	Radical Reactions	Chapter 37
04/03 (Wed.)	Lecture 19	Radical Reactions	Chapter 37
04/08 (Mon.)	Lecture 20	Carbenes	Chapter 38
04/10 (Wed.)	Lecture 21	Review for Exam 3	
04/15 (Mon.)	*Exam 3 (Lecture 15 to Lecture 21)*		
04/17 (Wed.)	Lecture 22	Participation, Rearrangement, and Fragmentation	Chapter 36
04/22 (Mon.)	Lecture 23	Exam 3 Discussion/Participation, Rearrangement, and Fragmentation	Chapter 36
04/24 (Wed.)	Lecture 24	Transition Metal Catalysis	Chapter 40
04/29 (Mon.)	Lecture 25	Organic Chemistry of Life	Chapter 42

Assessments: 1) **The assessments will be based on three mid-term exams and one final exam.** Each mid-term exam will be worth 100 points. The mid-term exams will primarily comprise open-ended questions, along with a few multiple-choice questions. The final exam, worth 200 points, will be cumulative, covering the entire year. Following tradition of 315/316, we will use the ACS Organic Chemistry Exam as the final, which consists of 70 multiple-choice questions. The mid-term exams are scheduled in class during the lecture, each lasting 80 minutes. The final is scheduled for 110 minutes during the final exam period set by the University calendar and will be administered according to the Final Schedule (TBA).

2) **Students are not allowed to share information/items with or receive information/items from others in any way during exams.** Violation of this policy is the most egregious offense a student can commit against academic integrity. Please uphold our historically high degree of integrity and remain committed to completing your own work during exams.

3) **Unlike Chem 315, all exams in Chem 316 are closed book and closed notes.** The purpose is to help you focus on the most important part of the course—thinking—rather than spending numerous hours preparing cheat sheets and wasting precious time during exams trying to find answers in them. Calculators are not allowed. **Molecular models, including pre-made ones such as decalin or *t*-butyl cyclohexane, may be used during exams.** However, keep in mind that time management is likely to impact your exam performance, so avoid wasting time.

4) Approximately 50% of each mid-term exam will be based on practice problems and questions discussed in lecture notes. Work out these problems. Discuss them with classmates, instructors in office hours, and/or in class meetings, and have mastered the relevant concepts. In this way, a slight variant of the question that is given on an assessment will be straight-forward to solve. **This is designed to help reduce the stakes of each exam and is akin to having graded homework or simple in-class quizzes.**

5) The final letter grades will be determined based on the total points accumulated, on a 500-point scale. Each semester, the Honors Organic class is composed of exceptionally high GPA students who are also proficient in science. Historically, the grade distribution consists of around 60% 'A' grades and approximately 25% 'B+' grades. To help students assess their relative position in the course, the mean points value will be provided after each exam. On the other hand, grades are not assigned on a 'curve.' **Students are not competing for their grades.** If the whole class performs stronger or weaker compared to previous Chem 316 students, then the average letter grade will be higher or lower.

Conflicts: Certain pre-scheduled Rutgers activities may take precedence over our in-class mid-term exams, but this is extremely rare and applies only to students who are formally registered to participate in such an activity. **If a student has a conflict, that student MUST notify Professor Gu of such conflict(s) no later than 1/28/2024.** Please refer to RU Final Exam Policies Rule (under the section of Exam Conflicts) for what constitutes a valid exam conflict.

Missed Exams: Absence from an exam should follow the normal procedure: you should fill out a self-reported absence form, available at https://sims.rutgers.edu/ssra, and you must provide a letter of excuse from the DOS (addressed to Professor Gu) **within 3 days of the exam** or as soon as the emergency allows. There are no makeup exams. If a student has an excused absence, the missed exam grade will be assigned based on the average of all other exams (mid-terms and final). If a student has more than one excused absence, it may severely impact the letter grade, and the student should discuss the situation with the instructor.

Special Needs: All requests for extended time and/or other special accommodations for exams will be handled as per the policies of the Office of Disability Services (ODS). Any student requiring

extra time and/or other testing accommodations must provide documentation supporting their circumstances to ODS and to send the appropriate ODS form to Professor Gu **within the first week of classes** or immediately after these needs have been documented.

Academic Integrity: All University policies on academic integrity will be strictly enforced. Any cheating on exams or any facilitating of academic dishonesty will be dealt with promptly in strict accordance with the Rutgers University Academic Integrity Policy. A copy of the current Academic Integrity Policy, which went into effect on September 1, 2013, can be found at: http://studentconduct.rutgers.edu/student-conduct-processes/academic-integrity/

Canvas Website: The course will be using Canvas as a classroom management system. Students are expected to check Canvas site regularly, for course announcements, useful files, and exam results. Rutgers students who are registered in this course will automatically be a member of the online class.

Email: Email correspondence to Professor Gu should come from a Rutgers email account and contain the phrase "[Chem 316]" (including the bracket) in the subject line. **All emails from non-Rutgers email addresses will be ignored.** This policy is in place to ensure the privacy of each student because there is no feasible resource for the instructor to verify that a non-Rutgers email account belongs to one specific student. **All emails not containing [Chem 316] in the subject may be missed** because Professor Gu will use the exact phrase (including the bracket) to search for Chem 316 student emails periodically. Please check with your recitation instructors for their own rules regarding email correspondence.

SASHP Peer Tutoring: This is a free service provided by Rutgers University for students who would like to schedule a one-hour, one-on-one tutoring session in any of a variety of subjects. Often the tutor is a fellow Rutgers student who took the class in a previous semester and performed well in the class. For more information, please visit: https://www.sashonors.rutgers.edu/opportunities/engagement-leadership/tutoring-program.