

Intermediate Organic Chemistry II – Syllabus

Course: SC/CHEM 3021 N

Course Webpage: E-Class

Term: Winter Term 2023-24

Prerequisite / Co-requisite: SC/CHEM 3020 or permission from the course director

Course Instructor

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Office hours By appointment and within reason. Please come prepared.

Time and Location Monday & Friday: ACW 307
Wednesday: DB0014

Course Delivery In-person lectures. **Attendance is essential.**

Course Description. This course builds on material presented in CHEM 2020, CHEM 2021 and CHEM 3020 and is divided into two major areas. The first part of the course will deal with the chemistry of polyunsaturated systems. A brief review of pi-molecular orbitals (LCAO-MO) will be followed by discussions on conjugation, properties of conjugated systems (reactivity, stability, electronic transitions and UV-spectroscopy), aromaticity and the Hückel rule. Pericyclic reactions will be discussed, especially the Diels-Alder reaction, 3+2 cycloadditions, sigmatropic rearrangements and group transfer reactions. The second part of the course will introduce a variety of organic synthetic methods including reactions for the preparation and use of amines and amides, and an introduction to carbenes and ylides.

Course Objectives. The purpose of this course is to introduce and understand new reactivity patterns. Students will become familiar with the structure and reactivity of conjugated systems. Pericyclic reactions will be introduced, including cycloadditions, electrocyclizations, sigmatropic rearrangements and group transfer reactions. A second section of the course will introduce a variety of reactions for the synthesis of amines. Lastly, the chemistry of carbenes and ylides will be introduced.

Learning Outcomes

1. Understand the bonding and electronic structure of conjugated systems in a qualitative manner, and be able to construct molecular orbitals of conjugated systems using a qualitative LCAO approach.
2. Understand the reactivity of conjugated systems with electrophiles, and predict the product of their reactions under kinetic and thermodynamic control
3. Understand the effect of conjugation on the stability of organic molecules
4. Understand electronic transition of conjugated systems.
5. Be familiar with terpene natural products and how they arise from simple building blocks. Connect their structure to prior knowledge of conjugated systems
6. Develop an appreciation of pericyclic reactions and how they differ from ionic and free-radical reactions.
7. Understand the Diels-Alder reaction, including all selectivity factors. Predict the product of any Diels-Alder reaction. Understand how molecular orbitals determine the outcome of these reactions
8. Understand other cycloadditions, particularly 3+2 dipolar cycloadditions
9. Understand group transfer reactions, such as the Alder ene and the carbonyl ene reaction
10. Understand sigmatropic rearrangements, predict the equilibrium position of any sigmatropic rearrangement
11. Understand electrocyclization reactions and predict the outcome of any electrocyclization reaction based on the molecular orbitals involved
12. Understand and apply a variety of methods for the synthesis of amines and related systems (amides, amino acids, hydrazines, etc.) and appreciate their reactivity
13. Understand the reactivity and use of reagents for peptide synthesis. This includes coupling reagents and protecting groups.
14. Understand rearrangement reactions such as the Beckman, Schmidt, Tiffeneau-Demjanov, Pinacol, Baeyer-Villiger, Hydroboration/oxidation, etc.
15. Understand fragmentation reactions
16. Understand the structure and reactivity of carbenes, and methods for their preparation
17. Understand the reactivity of Ylides and their uses.
18. Develop an appreciation of simple conformational analysis
19. Develop an appreciation of complex molecule synthesis

Course Text / Readings

Tools and Textbooks. *The use of chemical model kits is strongly encouraged* as a study tool as you review, solve problems and write exams. Your ability to appreciate molecules as three-dimensional entities will greatly enhance your understanding of the material. Course notes will be provided in the form of PDF files of PPT slides as the course progresses. There will be extensive discussion that is not included in the notes, therefore I strongly encourage you to watch every video and attend every discussion session.

Evaluation

Quizzes: 3x5% (15%) - quizzes are **not announced**, and no accommodations are made. Best three results count.

Midterm 1: 25% - **Monday February 12.**

Midterm 2: 25% - **Monday March 11.**

Final Exam: 35% - Exam date is decided by the registrar's office.

Missed Tests: No make-up tests are given. The weight of a missed test is transferred to the final exam.

“Final course grades may be adjusted to conform to Program or Faculty grades distribution profiles.”

Grading: The grading scheme for the course conforms to the 9-point grading system used in undergraduate programs at York (e.g., A+ = 9, A = 8, B+ = 7, C+ = 5, etc.). Assignments and tests* will bear either a letter grade designation or a corresponding number grade (e.g. A+ = 90 to 100, A = 80 to 90, B+ = 75 to 79, etc.)

Students may take a limited number of courses for degree credit on an ungraded (pass/fail) basis. For full information on this option see Alternative Grading Option in the Faculty of Science section of the Undergraduate Calendar: <http://www.yorku.ca/roweb/enrol/passfail/>

University Policies

Academic Honesty and Integrity

York students are required to maintain the highest levels of academic honesty and they are subject to the Senate Policy on Academic Honesty. The Policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards.

There is also an academic integrity website with comprehensive information about academic honesty and how to find resources at York to improve students' research and writing skills, and cope with university life. Students are expected to review the materials on the Academic Integrity website.

Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third party repository sites (e.g. Course Hero, One Class, Chegg, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be willfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, students are urged not to upload their work to these sites. Whenever a student submits work obtained through Course Hero, Chegg or One Class, the submitting student will be charged with plagiarism and the uploading student will be charged with aiding and abetting.

Note also that midterms, final exams, lecture slides and other course materials are the copyrighted work of the Professor, whether copyright is overtly claimed or not (i.e. whether the © is used or not). Scanning these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites. Screen capturing the lecture, tutorial, or any other component of the course also constitutes copying, which is a breach of copyright.

Students are required to make themselves aware of school policies relating to Academic Honesty and Integrity, Access, Religious Accommodation, Student Conduct and other matters. Plagiarism and other academic offenses will be sanctioned to the fullest extent in accordance with university and Faculty policies.

A summary of these policies can be accessed at

<http://www.yorku.ca/secretariat/senate/committees/ascp/documents/CourseInformationForStudentsAugust2012.pdf>

Universal Access and Equity

York University is committed to the principles of respect, inclusion and equality of all persons with disabilities across campus. The university provides services for students with disabilities (including physical, medical, learning and psychiatric disabilities) needing accommodation relating to teaching and evaluation methods/materials. These services are made available to students in all faculties and programs at York University.

Students in need of these services are encouraged to register with counselling and disability services (CDS) as early as possible to ensure that appropriate accommodation can be provided with advance notice. Students may wish to discuss the nature of their accommodations with their professor early in the term.

Many students registered with CDS are entitled to midterm and final exam accommodations such as extra time. These students must register and book their tests and exams with the Alt Exam Centre at York as soon as possible.

Additional information is available at the following websites:

Counselling and Disability Services: <http://cds.info.yorku.ca> York Accessibility Hub: <http://accessibilityhub.info.yorku.ca> Alternate Exam Centre: <http://altexams.students.yorku.ca>

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community, and making accommodations for observances of special significance to adherents.

Please note that to arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete an Examination Accommodation Form, which can be obtained from Student Client Services, Student Services Centre or online at https://registrar.yorku.ca/sites/registrar/files/pdf/exam_accommodation.pdf at least 3 weeks before the final exam and submitted to the course director.

Student Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at : <http://secretariat-policies.info.yorku.ca/policies/disruptive-andorharassing-behaviour-in-academic-situations-senate-policy>