

Synthetic Organic Chemistry – Syllabus

Course: SC/CHEM 3021 N

Course Webpage: Moodle access

Term: Winter Term 2018/19

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

Course Instructor

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Office hours: by appointment. Please do not visit me if you are sick.

Time and Location

Lectures	Monday, Wednesday & Friday 11:30-12:30
Location	All classes in LSB 105

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 p-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 polygon rule. Pericyclic reactions will be discussed, specially the Diels-Alder reaction, 3+2 cycloadditions and sigmatropic rearrangements. The second part of the course will introduce a variety of organic synthetic methods including a variety of reaction for the preparation and use of amines and amides, 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 of conjugated systems will be introduced, including cycloadditions and electrocyclizations, and this will be followed by 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 the structure and reactivity of carbenes, and methods for their preparation
16. Understand the reactivity of Ylides and their uses.
17. Develop an appreciation of simple conformational analysis
18. 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 as the course progresses. Although they are fairly comprehensive, there will be extensive discussion that is not included in the notes, therefore I strongly encourage you to attend every class. I also strongly encourage you to print these notes before the lecture and have them with you during the class. The use of **laptop computers and cell phones** during class is **strongly discouraged**. No textbook is required, however, the following text has been placed on reserve at the Steacie Science library. This textbook can be purchased online (e.g. Amazon). Some of the material covered can also be found in *Organic Chemistry* by Wade, used in all previous organic chemistry courses.

Organic Chemistry

Clayden, Greeves, Warren and Wothers (2001, 1st Ed./ 2012, 2nd Ed.)

QD 251.3 O64 2012

Evaluation *

The final grade for the course will be based on the following items weighted as indicated:

Quizzes*	10% (3 quizzes or more, best three quizzes count) *POP Quizzes are not announced.
Midterms	2 x 25% tentative dates: Week of February 13 and Week of March 13, final dates to be determined after consultation with class
Final exam	40% (date TBD by registrar's office)

Missed Quizzes: No make-up quizzes are given.

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.)

(For a full description of York University Undergraduate Calendar - <http://calendars.registrar.yorku.ca/2010-2011/academic/index.htm>

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/>

IMPORTANT COURSE INFORMATION FOR STUDENTS

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 (<http://secretariat-policies.info.yorku.ca/policies/academichonesty-senate-policy-on>). 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 (<https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity>).

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>

Students with accommodation letters issued by CDS should submit them to the CHEM 1001 office in CB 124 or electronically to genchem@yorku.ca rather than to their lecturers.

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.

For requests regarding midterm exams, requests must be received by the course director at least 2 weeks in advance (there is no equivalent online form).

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>

January 2019