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General information

Instructor: Dr. Amanda Bongers (she/her), CHE 507, amanda.bongers@queensu.ca

Learning Hours: 120 (36 Lecture, 12 Tutorial, 72 Private Study)

Requirements: Prerequisite CHEM 311/3.0 and CHEM 314/3.0.

Land Acknowledgement

Queen's University sits on the [traditional lands of the Haudenosaunee and Anishinaabek peoples](#). I am grateful that we can learn, teach, and work on these lands. Chemistry is the “central science,” meaning that choices made by chemists have broad impacts on the land and its people. We must consider both its potential benefits and hazards as scientists to ensure we respect and protect these lands.

Class Sessions

This course is student-centered and designed around active and experiential learning. In class, we will use quizzes, discussions, and activities. You must do the weekly readings to be prepared for class activities! There is assigned reading from the textbook, *Organic Chemistry*, Second Edition, Clayden, J.; Greeves, N.; Warren, S. Oxford University Press, New York, 2012., and other resources like journal articles (see OnQ).

Tutorials: Weekly tutorials will be used for office hours and additional activities.

Structure of this Course

The course is organized into modules completed over a 12-week schedule (see OnQ). The folders in OnQ contain all the resources and activities for each week.

WEEK	TOPIC - CONTENT	TOPIC - SKILL	KEY ASSESSMENTS
WEEK 1	Retrosynthetic Analysis	Mechanisms, efficiency	Quiz 0
WEEK 2	Selectivity	Choosing a disconnection	Literature Review 1
WEEK 3	C-X, Protecting Groups	Order of events	Quiz 1
WEEK 4	Amines, C-H metalation	Oxidation state management	Project Milestone 1
WEEK 5	C-C, carbonyls	Control in carbonyl condensations	Literature Review 2
WEEK 6	C-C 1,3; 1,5; and 1,2	Regioselectivity	Quiz 2
BREAK			
WEEK 7	Stereoselectivity	Controlling selectivity	Literature Review 3
WEEK 8	Alkenes, alkynes	Controlling geometry	Project Milestone 2
WEEK 9	Rings	Intramolecularity	Quiz 3
WEEK 10	Pericyclics/Rearrangements	Umpolung and reversal	Literature Review 4
WEEK 11	Total synthesis case studies	FAG and reconnection	Quiz 4
WEEK 12	Project Milestone 3: Final Presentations		

Learning Outcomes

The goal of this course is to learn about modern synthetic methods in organic chemistry. We will discuss principles and strategies for planning organic syntheses, classify reagents and reactions, and learn how to control stereochemistry. You will use your growing knowledge to design your own synthesis plan.

By the end of this course, students will be able to:

1. **Apply retrosynthetic analysis**

Perform retrosynthetic analysis to design efficient synthetic routes for complex organic molecules, identifying key disconnections and strategic synthetic transformations.

2. **Evaluate and propose reaction mechanisms**

Predict and interpret reaction outcomes by evaluating the reactivity and conditions, and use this to suggest or explain reaction mechanisms.

3. **Design and optimize reaction conditions**

Identify challenges and unexpected outcomes in reactions, and propose ways to optimize conditions and improve factors such as yield, selectivity, and scalability.

4. **Plan a multistep synthesis**

Using an iterative and feedback-driven approach, plan a multistep organic synthesis, integrating various synthetic methodologies to achieve the target molecule.

5. **Conduct literature Reviews**

Critically evaluate research articles related to synthetic organic chemistry and extract relevant information to inform research and synthesis strategies.

6. **Communicate scientific problems and findings**

Effectively communicate about synthetic organic chemistry, conveying complex synthetic strategies, results, and interpretations through written reports and oral presentations.

Communication

As much as possible, we will keep communications about the course within class sessions. Before emailing me, ask yourself if other people may have the same question, and if yes, then ask it in class. If you need accommodations, advice, or guidance, please let me know! I am here to help. You can send an email to schedule office hours.

The university communicates with students via Queen's email. Please check your email regularly to ensure you do not miss important information. **Note:** You may have two email addresses: one is your student email address, and the other is your employee email address (used for TA).

Class Attendance

Your presence and participation in class contribute to the knowledge and skills that you will develop throughout this course. I expect that you attend class regularly and participate in class conversations and learning activities. These types of activities provide active engagement, promote a deeper understanding of the course content, and contribute to your success in this course.

Assessments

There are different types of assessment in this course, each one connected to the learning outcomes listed above. Your work must be submitted for instructor and/or peer feedback throughout the term. Assignments (e.g., literature reviews) have an automatic 72 (3 day) hour grace period, which covers any extra-time accommodations. Late work may be accepted without penalty after a conversation with the instructor.

Quizzes (60 pts): *Quizzes are the only assessments which are graded for marks.* There will be 4 quizzes completed during class time. The lowest grade will be automatically dropped.

Literature Reviews (60 pts): Every other week, you will discuss assigned readings with your peers. You are responsible for planning and reading ahead of class. For each you will prepare an introduction and summary before class, then add a discussion and reflection after class. Literature reviews are not graded but will be returned with instructor and/or peer feedback. Peer feedback can be completed for up to **8 bonus points**. *You must record these as "complete" yourself using the online declaration form.*

Problem Sets (10 pts): Problem sets are completed in class and in groups. During class sessions, the solutions are discussed and feedback is provided by the instructor. During class, you take notes and, by the end, write a summary of the problem set and show it to your instructor. *You must record these as "complete" yourself using the online declaration form.*

Final Project (80 pts): Design a total synthesis of a newly discovered molecule. Throughout the term, you will work on this project and complete several milestones, which you *must record these as "complete" yourself using the online declaration form.* You will receive regular instructor and peer feedback. At the end of the class, you will present your work to class.

Grading

Literature reviews, problem sets, and projects will receive points for completion. Only quizzes are graded (also for points). The final grade you receive for the course will be derived by converting your points to a letter grade according to Queen's Official Grade Conversion Scale. Estimates are given below, and see onQ for full scale.

Timeline	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-
End of week 4	62	60	59	57	56	54	53	52	50	48	47	46
End of week 8	130	126	122	118	114	110	106	102	98	96	94	92
End of week 12	200	195	190	185	180	175	170	165	160	155	150	145

Additional Information and Guidelines from Queen's

Course Technology

In this course you may need to use the following technology, available for free online and in the [ITS Software Centre](#):

- Word, PowerPoint
- A free PDF annotator (highlight, add notes, draw) such as DrawBoard PDF

Internet Speed: A minimum download speed of 10 Mbps and up to 20 Mbps for multimedia is recommended. To test your internet speed, <https://www.speedtest.net/>

For technology support ranging from setting up your device, issues with onQ to installing software, contact ITS Support Centre <https://www.queensu.ca/its/itsc>

Netiquette

In any course, you often communicate with your peers and teaching team through electronic communication. You are expected to use the utmost respect in your dealings with your colleagues or when participating in activities, discussions, and online communication.

Here is a list of netiquette guidelines. Please read them carefully and use them to guide your communication in this course and beyond.

- Make a personal commitment to learn about, understand, and support your peers.
- Assume the best of others and expect the best of them.
- Acknowledge the impact of oppression on the lives of other people and make sure your writing is respectful and inclusive.
- Recognize and value the experiences, abilities, and knowledge each person brings.
- Pay close attention to what your peers write before you respond. Think through and re-read your writings before you post or send them to others.
- It's okay to disagree with ideas, but do not make personal attacks.
- Be open to being challenged or confronted on your ideas and to challenge others with the intent of facilitating growth. Do not demean or embarrass others.
- Encourage others to develop and share their ideas.

Notice of Recording

In the event that synchronous (live) classes are necessary, they will be delivered in this course through a video conferencing platform supported by the University MS Teams or Zoom. Steps have been taken by the University to configure these platforms in a secure manner. Classes MAY be recorded with video and audio (and in some cases transcription) to be made available to students in the course for the duration of the term. You will be informed if the class session is being recorded. The recordings may capture your name,

image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen's University, please see the general [Notice of Collection, Use and Disclosure of Personal Information](#).

[Accommodations for Disabilities](#)

Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016 ([see this file](#)). If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the **Queen's Student Accessibility Services (QSAS)** and register as early as possible. For more information, including important deadlines, please visit the QSAS website at: <http://www.queensu.ca/studentwellness/accessibility-services/>

If you need an accommodation, contact your instructor.

[Academic Consideration for Students with Extenuating Circumstances](#)

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time. The Senate Policy on Academic Consideration for Students in Extenuating Circumstances [is available at this link](#).

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted at:

<http://www.queensu.ca/artsci/accommodations>. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty. If you need to formally request academic consideration for this course, you will be required to provide the name and email address of the instructor/coordinator. Please use the following:

Instructor/Coordinator Name: Amanda Bongers

Instructor/Coordinator email address: amanda.bongers@queensu.ca

Statement on Academic Integrity

Queen's students, faculty, administrators and staff all have responsibilities for upholding the fundamental values of academic integrity; honesty, trust, fairness, respect, responsibility and courage (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities <http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities>).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and their behaviour conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1>), on the Arts and Science website (see <https://www.queensu.ca/artsci/students-at-queens/academic-integrity>), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Students must submit their own work and cite the work that is not theirs. Generative AI writing tools such as ChatGPT are only permissible when explicitly noted in the assignment instructions. In these cases, be sure to cite the material that they generate. Any other use constitutes a departure from academic integrity.