UNIVERSITY OF TORONTO DEPARTMENT OF CHEMISTRY

CHM 1057H – Spring 2024 Selected Topics in Organic Chemistry

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Classes:

Part A – Prof. Yudin Section

Class time: 2:10-4:00 pm

Class dates and locations:

Date	Location
Jan 31 (Wed)	OI 2205
Feb 7 (Wed)	OI 2205
Feb 9 (Fri)	SS 1084
Feb 14 (Wed)	OI 2205
Feb 16 (Fri)	SS 1084
Feb 28 (Wed)	OI 2205

Part B – Prof. Rousseaux Section

Class time: 2:10-4:00 pm Class dates and locations:

Date	Location
Mar 4 (Mon)	FE 222
Mar 6 (Wed)	FE 222
Mar 25 (Mon)	FE 222
Mar 27 (Wed)	FE 222
Apr 3 (Wed)	FE 222
Apr 8 (Mon)	FE 222

Student Hours:Sophie Rousseaux: by appointment (sophie.rousseaux@utoronto.ca)Andrei Yudin: by appointment (andrei.yudin@utoronto.ca)

Course Website: https://q.utoronto.ca/

It is important that you check the course website periodically for announcements, lecture notes, etc.

Course Description:

CHM1057 consists of two parts: A) Mechanistic Organic Chemistry and B) Asymmetric Synthesis

Part A) This section of the course will focus on fundamental energetic parameters of organic transformations. We will discuss various cases that highlight the use of kinetic and thermodynamic control, Hammond postulate, Curtin-Hammett principle, Benson increments, heats of formation and their use, microscopic reversibility, and isodesmic reactions. We will cover the details of electrostatic and orbital control, formulation of common transition state assemblies in organic chemistry, various heuristics (such as homology and vinylogy). Particular attention will be devoted to understanding oxidation states of carbon and their relevance to strategic selection building blocks, industrial organic chemistry, spatioenthalpic analysis, synthetic half-reactions, reactive intermediates, and multicomponent reactions. Students should ensure that they are familiar with material at least up to the level of CHM342, before beginning this section.

Part B) Asymmetric Synthesis and Catalysis. This section of the course will focus on topics in asymmetric synthesis and catalysis. Selected topics include asymmetric hydrogenations and oxidations; kinetic resolution, dynamic kinetic resolution and DYKAT; ligand design, etc. Students should be familiar with basic aspects of asymmetric synthesis from CHM342/343 and course notes for review will be posted on Quercus.

Students should therefore ensure that they are familiar with material covered in CHM342 and CHM440 (CHM1004) before taking this course. Access to the lecture notes from CHM342 and CHM440 (CHM1004) can be provided upon request.

Marking Scheme:

Part A – Mechanistic Aspects of Organic Chemistry (50% of final mark)

- 35% assignment (see below for details)
- 15% test (date and time TBA)

Assignment (35% of final grade) – Spatioenthalpic analysis of chemical transformations

The assignment will relate to analysis of known transformations from the standpoint of their formal division into steps that are enthalpically matched with each other to provide the overall driving force. You will work in groups for this assignment. The details will be announced in class and the deadline for the assignment is going to be March 1, 2023.

Part B – Asymmetric Synthesis and Catalysis (50% of final mark)

- 35% assignment (see below for details)
- 15% test (date and time TBA once undergraduate exam timetable is out)

Assignment (35% of final grade) – Preparation of a Tutorial Review on a topic of your choice in the field of asymmetric synthesis and catalysis

Chem. Soc. Rev. publishes Tutorial Reviews that are "concise, authoritative overviews of important contemporary topics in the chemical sciences. They should appeal to advanced undergraduates, the general research chemist who is new to the field, as well as the expert. They provide a solid introduction to the development of a subject, the latest breakthrough results and their

implications for the wider scientific community." For this assignment, <u>you will be working in small</u> <u>groups</u> to prepare a tutorial review (in presentation format) on a topic of your choice in the field of asymmetric synthesis and catalysis.

The assignment will be broken down into steps, similar to the process for submission of Tutorial Reviews in Chem. Soc. Rev. More details about these steps (and a more detailed marking scheme) will be provided during the first class of Part B of the course (March 5, 2024).

- 1) Submission of a tutorial review proposal form (tentative deadline: March 20, 2024). Your topic must be approved by the course instructor.
- 2) Presentation of a 15-minute tutorial review (this will replace the written tutorial review) (tentative deadline: in class, last two classes (dates TBD))
- 3) Peer-review of your presentation (deadline TBD)

IMPORTANT NOTICE: The deadline for students to cancel a course without academic penalty for the Winter 2024 session is February 20th. Please note that you will not have term work returned by this date.

Lecture Notes: If lecture notes have been posted, please print them ahead of class. We would recommend that you *read posted handouts ahead of the associated lectures*.

Required Text: There is no required textbook. The lecture notes and associated readings will form the basis of the course.

A good general reference that outlines the basics of organic reactions and reactivity is:

Clayden, J.; Greeves, N.; Warren, S. *Organic Chemistry*, Oxford University Press **2012**. 2nd Edition.

Periodically, you will be provided with papers to read and you are expected to study these materials ahead of your next class.

Course Policies:

Each member of this course is expected to maintain a:

- (i) professional and respectful attitude during all course activities, including classes, laboratories, tutorials, and other online activities.
- (ii) personal calendar/schedule/organizer to ensure that all course activities are completed, and due dates are met.
- (iii) collection of notes recorded independently based on concepts covered in course activities (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation)
- (iv) familiarity with the university policy on Academic Integrity

The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. The CHM1057 Teaching team will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and we wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes

discussion. Discrimination, harassment, and hate speech will not be tolerated. If you have any questions, comments, or concerns, we encourage you to reach out to the staff in our <u>Equity</u> <u>Offices</u>.

Institutional Policies and Support

Academic Integrity: Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously.

The <u>University of Toronto's Code of Behaviour on Academic Matters</u> outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see www.academicintegrity.utoronto.ca/).

Copyright: If a student wishes to copy or reproduce class presentations, course notes or other similar materials provided by instructors, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited. More information regarding this is available here: <u>https://teaching.utoronto.ca/ed-tech/audio-video/copyright-considerations/</u>

Accessibility Needs: Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact Accessibility Services as soon as possible.

Accommodations for religious observances: Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, tutorial, class or laboratory session. Students must inform the instructor before the session/assignment date to arrange accommodations.

Additional Services & Support:

The following are some important links to help you with academic and/or technical service and support:

- School of Graduate Studies' <u>Policies and Guidelines</u>
- Full library service and resources on conducting online research through University of Toronto Libraries <u>University Libraries Research</u>
- Resources on academic support from the <u>Academic Success Centre</u>
- Learner support at the <u>Writing Centre</u>
- Information for <u>Technical Support/Quercus Support</u>

Acknowledgement of Traditional Lands:

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.