CONCORDIA UNIVERSITY
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

CHEM 498/640 (section 53)
SELECTED TOPICS IN INORGANIC CHEMISTRY

Green Chemistry

Syllabus – Winter 2024

1. GENERAL INFORMATION

Green Chemistry (CHEM 498/640) is a one-term, 3.00 course open to all degree programs. This course requires CHEM 222 (Introductory Organic Chemistry II), CHEM 241 (Inorganic Chemistry I: Introduction to Periodicity and Valence Theory), and CHEM 217 (Introductory Analytical Chemistry I).

2. COURSE DESCRIPTION

This course will give an overview of the 12 principles of green chemistry and how they are applied in a laboratory and industrial setting. Recent literature will be used to highlight key advances and examples of processes relevant to the field green chemistry.

INSTRUCTOR	Professor Ashlee J. Howarth ashlee.howarth@concordia.ca
COURSE FORMAT	Lectures
LECTURE HOURS	Mon 6:00pm – 8:45pm (Synchronous, in-person: Mon 6:00-7:00pm)
LOCATION	LOY CC-425 and Zoom
TEXTBOOKS (for extra reading only)	*Green Chemistry, Theory and Practice.* Paul T. Anastas, John C. Warner, Oxford University Press, 1998. *Green Chemistry, An Inclusive Approach.* Béla Török, Timothy Dransfield (Eds). Elsevier, 2018.
COURSE WEBSITE	Moodle, CHEM-498-53-2234. CHEM 640-53
OFFICE HOURS	Mon 7:00pm (in-person) or email any time

3. TERRITORIAL ACKNOWLEDGEMENT

I would like to begin by acknowledging that Concordia University is located on unceded Indigenous lands. The Kanien'kehá:ka Nation is recognized as the custodians of the lands and waters on which we gather today. Tiohtià:ke/Montréal is historically known as a gathering place for many First Nations. Today, it is home to a diverse population of Indigenous and other peoples. We respect the continued connections with the past, present and future in our ongoing relationships with Indigenous and other peoples within the Montreal community.

4. IMPORTANT DATES

Lectures begin: Monday January 15th
Deadline to withdraw with tuition refund (DNE): Monday January 29th
CHEM 101 quiz closes: Sunday February 18, 2024 at 11:55 pm
Midterm exam I: Monday February 12th
Final Paper First Draft Due: Friday February 23rd
Deadline to withdraw (DISC): Wednesday April 17th
Final Presentation Due: Monday March 18th
Midterm exam II: Monday March 25th
Peer Reviewer Reports Due: Monday April 8th
Lectures end: Monday April 15th
Final Paper Due: Wednesday April 24th

5. LECTURE FORMAT and READINGS

Classroom time is divided between asynchronous lectures and synchronous, in-person, discussions on recent scientific literature relevant to the material covered. Each week, students will be expected to watch pre-recorded video lectures plus read one assigned literature paper. Then, at the regularly scheduled class time (Mondays from 6-7pm), we will meet in-person to discuss the lecture content and the assigned literature paper from the week before. Given that course participation marks will come from participation in these weekly in-person discussions, i*f you cannot attend for any reason, please contact Prof. Howarth to make alterative arrangements.*

In the final weeks of the course, students will watch pre-recorded student presentations from their peers in place of pre-recorded video lectures. Then, during the weekly in-person discussion sessions in these final weeks, students will be expected to ask their peers questions about their presentations. Given that a portion of the final presentation grade will come from participation in these in person discussions (including asking questions and answering questions), *if you cannot attend for any reason, please contact Prof. Howarth to make alterative arrangements.*

6. COURSE OBJECTIVES

- To understand the history of the field of green chemistry, why it was created, why it is necessary, and the responsibility that chemists have with regards to the sustainability of our planet
- To describe the 12 principles of green chemistry, including the theory behind each principle, and approaches for applying the principles in all fields of chemical research
- To gain insight into current green chemistry literature, progress that has been made on both fundamental and applied levels, and the future challenges of the field

7. COURSE OUTLINE

1. Overview of the 12 principles of green chemistry including: (1) Prevention, (2) Atom Economy, (3) Less Hazardous Chemical Syntheses, (4) Designing Safer Chemicals, (5) Safer Solvents and Auxiliaries, (6) Design for Energy Efficient, (7) Use of Renewable Feedstocks, (8) Reduce Derivatives, (9) Catalysis, (10) Design for Degradation, (11) Real-time analysis for Pollution Prevention, (12) Inherently Safer Chemistry for Accident Prevention

2. Green chemistry in practice including: literature examples, commercial examples, and a brief overview of the periodic table of the elements of green and sustainable chemistry

8. EXAMINATIONS & ASSIGNMENTS

There will be two (2) formal examinations:

1. Midterm Exam I on **Monday February 12, 2024**
2. Midterm Exam II on **Monday March 25, 2024**

In addition to the Midterm Exams, there will be three (3) assignments required for completion of this course.

1. An oral presentation where students will explain a recent advance in the field of green chemistry. Students will select recent (2021-2024) papers on a pre-selected topic, and present the highlights of the work to the class. Presentations will be 10 minutes for undergraduate and 15 min for graduate students. Presentations can be recorded using PowerPoint, Zoom, Yuja or ActivePresenter. Due **Monday March 18, 2024**
2. A final paper where students will write a mini-review article on the scientific contributions from a prominent researcher in the field of green chemistry (a researcher will be chosen from an approved list). The first draft of the paper will be due **Friday February 23, 2024**. Then each student will receive two peer review reports (see assignment #3 below) on **Tuesday April 9, 2024**. Students will then have two weeks to correct their papers based on the peer review reports, with the final version due on **Wednesday April 24, 2024.**
3. Two peer review reports where each student will read the first draft of two papers, and prepare a one page report for each, giving constructive feedback on how the paper can be improved. The peer review reports are due on **Monday April 8, 2024.**

9. BEHAVIOUR

All individuals participating in courses at Concordia are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities (*https://www.concordia.ca/content/dam/common/docs/policies/official-policies/BD-3.pdf*) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

Sexual violence, including sexual harassment and sexual assault, is not tolerated at Concordia. Please see Concordia's policy on sexual violence for more information about awareness and prevention, support for survivors/ victims, responding to disclosures and procedures for reports and complaints. You can also contact the Sexual Assault Resource Centre for information and support. More information and support are available at the Sexual Assault Resource Centre: concordia.ca/students/sexual-assault, by email sarc@concordia.ca or phone 514 848-2424 x 3353

10. IP

Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

11. EXTRAORDINARY CIRCUMSTANCES

In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the changes.

12. ACADEMIC INTEGRITY *(Source: http://www.concordia.ca/students/academic-integrity.html)*

MANDATORY QUIZ AND SEMINAR

As part of your CHEM course, you are ***required*** to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (the passing grade for the quiz is 100%). (**Note:** this quiz is graded by the Department of Chemistry and Biochemistry, and you do not have access to it until after you have attended the seminar. Therefore, any other quiz you may have taken on the academic code of conduct does not count toward the CHEM 101 requirement.) The aim of this seminar and quiz is to clarify the academic conduct code in terms of which practices will be considered unacceptable with regards to work submitted for grading in your CHEM course. **You are only exempt from repeating the seminar and the quiz if you have done both in Winter 2019 or more recently,*** otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that you will not be given credit if you join too late and/or leave too early):

Date (Winter 2024)	Time	Mode	Registration link
Jan. 30 (Tuesday)	21:00-22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZEpduiqqj8rHNA4t_dWhFwnImOSHyjND38f
Feb. 1 (Thursday)	21:00-22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZIvf-ysrz8pGNFJEOnE8CqWvRYv_ADZ4arT

As space for each of the Zoom seminars is limited, please **register early** for your preferred slot (copy the corresponding link above into your browser). **Look out** for the Zoom email with the link to the actual seminar. Then do not forget to **attend** that seminar slot on the date above. You will **not** receive a reminder on or before the date!

We will take attendance at the Zoom seminar; this means that you must log in with the code that was supplied for your registration. Do not "join a friend" in watching at their computer.

If you do not complete this course requirement, your final grade for the course may be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.5) for details on removal of an incomplete notation.

* You are exempt if you can locate your ID in the pdf file located on the Departmental web site (http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance-list.pdf) and if there is no entry in the "quiz" column for you.

14. PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY

The academic code of conduct can be found in section 17.10 of the academic calendar (http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

15. CONCORDIA UNIVERSITY SERVICES FOR STUDENTS (partial list)

- Counselling & Psychological services: http://cdev.concordia.ca/
- Accessibility services: http://www.concordia.ca/students/accessibility.html

- Concordia Library Citation & Style Guides: http://library.concordia.ca/help/howto/citations.html
- Academic Integrity Website: https://www.concordia.ca/students/academic-integrity.html
- Student Advocacy Office: https://www.concordia.ca/offices/advocacy.html
- Financial Aid & Awards: http://www.concordia.ca/offices/faao.html
- Student Success Centre: http://www.concordia.ca/students/success.html
- New Student Program: http://newstudent.concordia.ca/
- Health Services: https://www.concordia.ca/students/health.html

16. COURSE GRADE

Your final grade in the course is based on marks obtained for lecture participation, midterm exams, final presentation, and final paper. The composition of the final course grade is as follows:

Participation	10 %
Midterm exam I	15 %
Midterm exam II	20 %
Final presentation	20 %
Peer review reports	10 %
Final paper	25 %

Passing Grades:

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-
100-93	92-86	85-80	79-77	76-73	72-70	69-67	66-63	62-60	59-57	56-53	52-50

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

A. J. Howarth
January 2024