



# Chemistry

UNIVERSITY OF TORONTO

## CHM 456H/CHM 1304: Organic Materials Chemistry

winter 2024 - Course Syllabus

### I TEACHING TEAM

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**Dwight Seferos** is a Professor of Chemistry, Chemical Engineering, and Canada Research Chair in Polymer Nanotechnology at the University of Toronto. Seferos began an independent career at the University of Toronto in 2009, was promoted to associate professor in 2014 and professor in 2017. Research in the Seferos group concerns the design, synthesis, characterization, and device engineering of organic materials and polymers for electronic and optical applications (OLEDs, solar cells, batteries, etc.). Seferos has authored or co-authored over 150 publications, holds numerous patents, and has been recognized by many national and international awards including the DuPont Young Professor Award, Alfred P. Sloan Research Fellowship, CSC Strem Chemical Award, ACS Harry Gray Award, E. W. R. Steacie Memorial Fellowship, the RSC Rutherford Metal in Chemistry, and the CIC Award in Macromolecular Science.

TA(s) TBA.

### II COURSE OVERVIEW

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#### COURSE DESCRIPTION:

Welcome to Organic Materials Chemistry! Not all organic chemistry involves the preparation of compounds for the pharmaceutical industry. In this course we will learn to design, synthesize, characterize and apply organic matter for high-tech uses.

Emphasis is placed on classic examples of organic materials including semiconducting polymers, molecular devices, self-assembled systems, molecular machines, as well as recent advances from the literature. You will study how structure in organic molecules dictates materials properties and ultimately leads to function. The objective of the course is learning structure-property relationships in carbon-based materials. Course information will be posted on the Quercus. **Please check frequently for updates.**

#### **STUDENT LEARNING OUTCOMES:**

1. Demonstrate an understanding of models of electronic structure, predict the behavior and properties of molecules and polymers in the solid-state.
2. Access, select and critically evaluate scientific literature in order to solve problems at the interface of chemistry, materials science and physics.
3. Take into account limitations, assumptions, and uncertainties in computational modeling, and justify the approach(es) taken.
4. Communicate scientific knowledge to diverse audiences clearly and concisely in a written journal-style report.
5. Work independently and collaboratively while exercising initiative, responsibility, and accountability in both personal and group contexts.
6. Reflect upon the dynamic nature of chemistry and value opportunities for updating your knowledge, understanding, and technical and professional skills as practitioners of the discipline.
7. Practice science with integrity and sensitivity to ethical, environmental, and social concerns, by committing to promoting diversity, equitable behaviour, academic rigour, and responsible leadership.

#### **PREREQUISITE COURSE(S):**

CHM 247H or CHM 249H; CHM 220H or CHM 222H (or equiv.). This course assumes you have a basic understanding of **organic chemistry** (structure, reactions), **basic analytical techniques**, **physical processes in molecules** (electronic and vibronic transitions), **basic physics** (simple electronic circuits). Recommended preparation CHM 223H; CHM 325H; CHM 342H/343H (or equiv.).

#### **READING:**

Required: There is no dedicated text for this course. Journal articles and review papers will be made available to complement the lecture notes

Supplemental: The required reading is supplemented with citations that are placed on the in-class notes/slides.

### **III COURSE ORGANIZATION**

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This course is organized by weeks.

**COURSE SCHEDULE & RELEVANT SESSIONAL DATES (SUBJECT TO CHANGE):**

DATES	UNIT/WEEK	TOPICS
January 9 <sup>th</sup> , 2024	1	Introductions, getting to know everyone, go over the syllabus, outline, course objectives. Introduction to Organic Materials Chemistry
January 16 <sup>th</sup> , 2024	2	Conducting and Semiconducting Polymers
January 23 <sup>rd</sup> , 2024	3	Organic solar cells
January 30 <sup>th</sup> , 2024	4	Organic light emitting devices
Feb. 6 <sup>th</sup> , 2024	5	<b>In-class term test #1</b> (~60 min) discussion of <b>Assignment #1</b>
Feb. 13 <sup>th</sup> , 2024	6	Molecular modelling; discussion of <b>Final Assignment</b> .
Feb. 20 <sup>th</sup> , 2024	7	Reading week. <b>*Assignment #2 Grads only*</b>
Feb. 27 <sup>th</sup> , 2024	8	<b>Assignment #1 due</b> ; high carbon-content materials, carbon nanotubes, graphene, 2D materials
March 5 <sup>th</sup> , 2024	9	Organic thin film transistors
March 12 <sup>th</sup> , 2024	10	Organic energy storage
March 19 <sup>th</sup> , 2024	11	Organic thermoelectrics
March 26 <sup>th</sup> , 2024	12	Organic bioelectronics
April 2 <sup>nd</sup> , 2024	13	<b>In class term test #2</b> (~60 min)
April 19 <sup>th</sup> , 2024	N/A	<b>Final Assignment Due</b>

## IV EVALUATION/GRADING SCHEME

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**OVERVIEW:**

Term test #1: In-class activity. 60 minutes, to be written during regularly scheduled class time.

Term test #2: In-class activity. 60 minutes, to be written during regularly scheduled class time.

Assignment #1: Take home assignment that will involve ChatGPT; details TBD.

Assignment #2: **\*GRADs ONLY\*** Take home assignment; details TBD.

Final Assignment: Assignment that will involve molecular modelling; details TBD.

Grading CHM 456:

Scheme A: Term test #1: Assignment #1: Term test #2: Final Assignment in a 20:10:20:50 weighted ratio.

Scheme B: Term test #1: Assignment #1: Term test #2: Final Assignment in a 30:10:30:30 weighted ratio.

**I will use the higher score.**

Grading CHM 1304:

Term test #1: Assignment #1: Assignment #2: Term test #2: Final Assignment in a 20:10:10:20:40 weighted ratio.

There will be an **additional assignment mandatory for the graduate students** during the reading week and comprise 10% of the overall evaluation for graduate students. Details are to be announced during the first 2 weeks of the course.

## **V COURSE POLICIES**

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- Each member of this course is expected to maintain a:
  - (i) professional and respectful attitude during all course activities, including classes, laboratories, tutorials and online activity.
  - (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 (overleaf)
- 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. As a Course Instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and 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 Equity Offices.
- **Process for signaling course absences and requesting make-up tests or other missed pieces of work.**

**If you are absent from your studies due to illness or other reasons and unable to complete course work (e.g., a term test or an assignment) then a piece of**

written documentation is required. The following four items are the recognized forms of documentation:

1. Absence Declaration via ACORN (please note the circumstances under which an absence declaration can and cannot be submitted)
2. U of T Verification of Illness or Injury Form
3. College Registrar's letter
4. Letter of Academic Accommodation from Accessibility Services

Students who complete the ACORN Absence Declaration form must additionally contact me/the course coordinator/the course administrator to discuss their situation within five business days of the missed piece of work. This is essential action for any consideration to be granted.

For extended absences and for absences due to non-medical reasons, make sure to contact your College Registrar's Office. They can help you decide between a request for an extension or other types of academic consideration.

If you suspect or know that you have a disability that is affecting your studies, learn about the services and supports available through Accessibility Services. A disability can be physical disability, sensory disability, a learning disability, mental health disorder or a short-term disability like an injury. If you are not sure whether you have a disability, you can confidentially contact Accessibility Services with your questions.

- Information regarding the use of artificial intelligence tools.
  - **Assignment #1.** Students may use artificial intelligence tools, including generative AI, to help produce this assignment. However, students are ultimately accountable for the work they submit. The documentation should include what tool(s) were used, how they were used, and how the results from the AI were incorporated into the submitted work. Any content produced by an artificial intelligence tool must be cited appropriately. Many organizations that publish standard citation formats are now providing information on citing generative AI (e.g., MLA: <https://style.mla.org/citing-generative-ai/>). Students are ultimately accountable for the work they submit.
  - **Assignment #2 \*Grad Only\*:** students may not use generative artificial intelligence tools.
  - **Final Assignment:** students may not use generative artificial intelligence tools.
- Communication with the instructor. I will respond to emails within a timely manner. If you do not hear back from me within 72 hours, I would encourage you to send a follow-up email. I won't be offended and will likely greatly appreciate the reminder!

- Privacy language and appropriate use of course materials: <https://teaching.utoronto.ca/ed-tech/audio-video/sample-statements/>
- Policy for late assignment submissions (10% will be deducted daily). An assignment is considered 1 day late if it is received 1 minute past the day/time it is due.
- Policy for reweighting due to missed pieces of academic work. Will need accurate documentation according to University policy. This is TBD on a case-by-case basis.
- Submission methods. **Use Quercus only.**

## **VI TECHNOLOGY REQUIREMENTS**

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- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: <https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/>
- Advice for students more broadly regarding online learning is available here: <https://onlinelearning.utoronto.ca/getting-ready-for-online/>
- Advice for students writing online assessments (quizzes etc.): <https://studentlife.utoronto.ca/task/online-exams-and-tests/>
- This course requires the use of computers, and technical issues are possible. When working on a piece of academic work, students are responsible for scheduling enough time to allow for reasonable delays due to technical difficulties to be overcome, so such issues will not be acceptable grounds for deadline extension. Particularly, maintaining an up-to-date independent backup copy of your work is strongly recommended to guard against hard-drive failures, corrupted files, lost computers, etc.

## **VII INSTITUTIONAL POLICIES & SUPPORT**

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### **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 University of Toronto's Code of Behaviour on Academic Matters

([governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019](http://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019)) outlines the behaviours that constitute academic dishonesty

and the processes for addressing academic offences. Potential offences include, but are not limited to:

In virtual laboratory reports:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any report. **Please note that the use of websites (such as Chegg.com or the course discussion board) to post virtual laboratory report material/questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**

On quizzes and term tests:

1. Using or possessing unauthorized aids. **Please note that the use of websites (such as Chegg.com or the course discussion board) to post quiz/term test questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**
2. Looking at someone else's answers or collaborating/discussing answers during a quiz or term test.
3. Misrepresenting your identity.

In general academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

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/](http://www.academicintegrity.utoronto.ca/)).

### **Use of Turnitin**

Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com website.

### **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: <https://teaching.utoronto.ca/ed-tech/audio-video/copyright-considerations/>

### **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:

- General student services and resources at [Student Life](#)
- Full library service through [University of Toronto Libraries](#)
- Resources on conducting online research through [University Libraries Research](#)
- Resources on academic support from the [Academic Success Centre](#)
- Learner support at the [Writing Centre](#)
- Information for [Technical Support/Quercus Support](#)

### **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.