

CHM 1488: CURRENT DIRECTIONS IN EXPERIMENTAL PHYSICAL CHEMISTRY

Fall 2023 Course Syllabus

I TEACHING TEAM



INSTRUCTOR (Weeks 1 – 4 and weeks 9 - END)

Name: Professor Al-Amin Dhirani

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Research: dhiranilab.wordpress.com

Online student hours: by appointment



INSTRUCTOR (Weeks 5 – 8 and weeks 9 - END)

Name: Professor Cynthia Goh

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Research: <http://www.gohlab.com/>

Online student hours: by appointment

II COURSE OVERVIEW

Welcome to **CHM1488H *Current Directions in Experimental Physical Chemistry!***

Experimental physical chemistry / chemical physics are obviously huge subjects, much too large to cover in a single course (indeed, even in a lifetime). At the same time, they are very active areas with significant cutting-edge opportunities: energy storage, cleaning our environment including our water and air, novel optoelectronics, state of the art spectroscopies, quantum materials and technologies are just a few applications.

Chlorophyll fluorescence



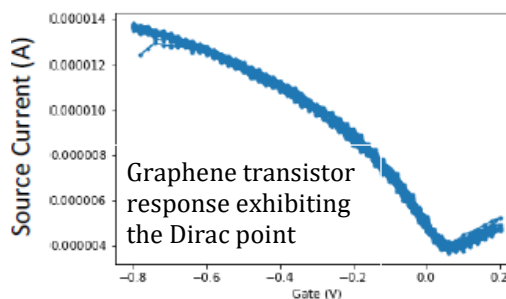
So, how should one start?

This course will provide a hands-on introduction to this subject using a combined guided and open-ended approach. In particular, the course will:

- 1) Discuss important fundamental principles and techniques commonly used in experimental physical chemistry/chemical physics;
- 2) Provide practice exercises (take-home kits with fundamental electro-optical components, an Arduino microcontroller, and an introduction to programming and data acquisition); and
- 3) Provide guidance and an opportunity to design and conduct your own experiment. (We will spare you the steps relating to raising funding!)

Examples of potential experimental projects include fabricating and characterizing:

- graphene transistors (Right panel)
- energy storage materials (e.g. carbon-based supercapacitors)
- electrochemical cells
- solar cells
- photoactive materials (see above)
- student's choice



The course content will be split 50:50 between electronics and optics/experimental design – taught by Profs. Dhirani and Goh, respectively. Both instructors enjoy combining physical principles and experimental methods + apparatus to solve interesting and useful problems. We hope to share that sense with all students in this course.

PREREQUISITE COURSE(S):

This course assumes you have a fundamental understanding of undergraduate physical chemistry and 1st year calculus.

REFERENCE MATERIAL:

There is no required textbook for this course. For the electronics related portions of the course, “*The Art of Electronics*” by Horowitz and Hill is useful reference for extra reading. The classic book for anyone attempting to build scientific apparatus is “*Building Scientific Apparatus*” by JH Moore et al., and even more classic is E. Bright Wilson’s “*An Introduction to Scientific Research*” available as a Dover edition. It’s a little bit dated (it was written in 1952 after all) but covers everything a researcher should know! None of these are textbooks but would make for excellent education!

III HOW THE COURSE IS ORGANIZED

- Weeks 1 – 4: fundamental of electronics and an introduction to data acquisition and programming;
- Weeks 5 – 8: optics and experimental design; and
- Weeks 9 – term end: a student-led experiment.

Although the student – led experiment formally begins in week 9, students should start their literature search earlier and complete ordering materials/components so that they arrive by week 9. Students will be given kits at the start of term to practice/extend concepts learned in classes and to use as needed to conduct their own experiment.

IMPORTANT FALL 2023 SESSIONAL DATES:

- First Day Fall classes: 7th September
- Thanksgiving (no classes): 9th October
- Fall Reading Week (no classes): 6th – 10th November
- Last Day of classes: 6th December

IV EVALUATION/GRADING SCHEME

Homeworks: 70%

Presentation of student-led experiment: 30%

V COURSE POLICIES

- Course website: q.utoronto.ca (in your Quercus Dashboard, click on “CHM 1488H 2023 Fall”)
Important: please check the Quercus course website regularly:
 - ✓ general course information
 - ✓ class notes
 - ✓ important announcements related to all assessments, classes, and laboratories
- Each member of this course is expected to maintain a:
 - ✓ professional and respectful attitude during all course activities, including classes, laboratories, and online activity;
 - ✓ personal calendar/schedule/organizer to ensure that all course activities are completed, and due dates are met;
 - ✓ 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);
 - ✓ familiarity with the university policy on Academic Integrity as it pertains to CHM 1488 (see page 4)
- Email will generally be responded to within 24 hrs. on weekdays. Email will only be accepted if: (1) You send it from your utoronto.ca account; (2) You identify yourself in the e-mail subject as a student in CHM 1488 and include your name and University of Toronto student ID number.
- 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 course teaching team 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](#).
- Any course audio/video recordings belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright: for concerns about audio/video recordings in which you appear please contact your instructor. *Students may not create audio or video recordings of classes except for those students requiring an accommodation for a disability, who should contact the instructor prior to beginning to record classes for written permission.* Students creating unauthorized audio recording of classes violate an instructor’s intellectual property rights and the Canadian Copyright Act. Students violating this agreement will be subject to disciplinary actions under the Code of Student Conduct. Course audio/video recordings may not be reproduced or posted or shared anywhere other than the official CHM 1488H Quercus site and should only be used by students currently registered in the course.

- Students who are absent from class for any reason (e.g., COVID-19 illness, other illness or injury, family situation) and who require consideration for missed academic work should report their absence through the online absence declaration. The declaration is available on ACORN under the Profile and Settings menu.

VI 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 University of Toronto's Code of Behaviour on Academic Matters (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 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 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.**

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 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.

ACCESSIBILITY NEEDS:

Students with diverse learning styles and needs are welcome in CHM 1488H. 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. If possible, please submit your accessibility letter at the beginning of the course and not right before an assignment is due.

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.