



Chemistry

UNIVERSITY OF TORONTO

CHM 317H: INTRODUCTION TO INSTRUMENTAL METHODS OF ANALYSIS

Winter 2023 Course Syllabus

I TEACHING TEAM

LECTURE INSTRUCTOR



Name: Prof. Rebecca Jockusch

Email: Rebecca.jockusch@utoronto.ca

Office: Lash Miller 253

Student hours (provisional – see course website for links and any updates): Mondays 12:45-1:45 & Wednesdays directly after class until 4:00 pm in LM253, or online by appointment.

LABORATORY INSTRUCTOR



Name: Prof. David Stone

Email: david.stone@utoronto.ca

Office: LM218 (but not used in pandemic times)

Student hours: During labs MTW 10-noon or by appointment

II COURSE OVERVIEW

COURSE DESCRIPTION:

CHM317 is designed to familiarize upper-level undergraduate students with important aspects of instrumental analysis. It is the second in a series of courses covering the science of chemical detection, identification, and measurement. It builds on principles and practices discussed in CHM217. Course topics include optical spectroscopies (absorbance, scattering, emission), mass spectrometry and chemical separations.

STUDENT LEARNING OUTCOMES:

What students can expect to know and be able to do by the end of the course.

By the end of CHM317, students will be able to

- understand how the instrumental techniques discussed in the course (several optical spectroscopies, mass spectrometry and separations) exploit fundamental chemical and physical properties for chemical analyses
- understand, describe and apply the operating principals of the instruments discussed in this course (instruments for measuring UV/visible absorption, IR absorption, fluorescence, tandem mass spectra and separations based on liquid- and gas-chromatography).
- evaluate and use data obtained using the instrumental methods and techniques discussed.
- account for sources of error and noise in instrumental analyses.

- understand the advantages and limitations of the various instrumental techniques discussed, and through this knowledge be able to choose appropriate analytical method(s) to address analytical challenges.

PREREQUISITE COURSE(S):

This course builds on principles and practices discussed in CHM217 (Introduction to Analytical Chemistry), which is a prerequisite for this course. Calculus I and II (e.g., MAT 135 & MAT 136) or equivalent are also prerequisites.

READINGS:

Required: "Principles of Instrumental Analysis," Skoog, Holler and Crouch, 6th Edition (Thomson & Brooks/Cole) or 7th Edition (CENGAGE Learning).

III COURSE ORGANIZATION

CHM317 is comprised of both "lecture" and "laboratory" components. Each week you are expected to participate in two, 50-minute "lecture" classes and a "laboratory" session. We anticipate that all lecture and laboratory components will be held *in person*. We will endeavor to make backup recording of lectures, but not labs, available to students. Please check our course Quercus website for any updates or changes to lectures and lab, as changes may become necessary due to ongoing health concerns.

Final course marks depend on your performance on three tests (totaling 60% of the course mark) and the laboratory mark (40%). The laboratory mark includes marks for lab performance, writing exercises, and four written lab reports (see below).

"Lecture" classes start on Monday, January 9. Classes are held Mondays and Wednesdays 2:10-3:00 pm. As of December 5th, our room assignments are

Mondays: SS1069

Wednesdays: SS1087

Please check the Quercus course website for any updates

Notes for lecture will be posted to the course website before class. In past years, many students have found that they learn best by taking their own notes, and only using the posted notes as backups. Other students prefer to annotate the pre-posted notes.

A tentative schedule of lecture topics with reading assignments will be posted on the course website accessible through Quercus. Several optical spectroscopies will be the focus of the first half of the semester (and the first two term tests). We will then move on to discuss mass spectrometry and end the semester by focusing on separations. We strongly recommend "pre-reading" the text before the associated class periods. This will enable deeper discussion of topics.

Problem Sets will be posted on the Quercus website as the course progresses. The problem sets will not be collected or graded; however, completing the problem sets

is the single best method to prepare for the two midterms and the final assessment. Answers will also be posted, but the instructors urge you not to look at the answer keys until you are certain that you have the correct answers. If you are uncertain how to solve a problem, it is much better to discuss the problem with your peers, TAs or course instructors before turning to the posted answers.

Practicals (labs) There will be mandatory orientation sessions in the first week of classes (see below). In-person labs begin the following week (January 16). Full details and all lab materials will be available through Quercus. Evaluation will be based on laboratory performance, a writing development exercise, and four formal reports.

IMPORTANT COURSE AND SESSIONAL DATES:

January 9: first day of CHM317 class

January 9, 10, or 11: lab orientation session (10:00-noon)

January 16, 17 or 18: first day of regular CHM317 lab

February 15, no lecture, term test 1, 6:30-8:00 pm

February 20-24: family day and reading week (no classes)

March 20: no lecture, term test 2, 6:10-8:00 pm

April 5: last day of CHM317 class

Final assessment: date and time to be announced

LABORATORY OBJECTIVES:

The overall goal of the laboratory component is to provide students with practical experience in using significant instrumental methods for chemical analysis. Students will, in addition, have opportunities for developing and demonstrating key transferrable skills such as: collaboration, communication (primarily written), data analysis and interpretation, and safe working practices. Students will gain experience with techniques including: reflectance FTIR, fluorescence, and atomic spectroscopy; and both gas and liquid chromatography.

IV EVALUATION/GRADING SCHEME

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| Term Test 1: (February 15, 6:30-8:00 pm) | 12% |
| Term Test 2: (March 20, 6:10-8:00 pm)) | 23% |
| Final Assessment | 25% |
| Laboratory Mark | 40% |
| <hr/> | |
| Total | 100% |

Please inform Prof. Jockusch as early as possible if you are unavailable during a scheduled assessment time. Alternate test sittings or an oral test may be arranged to make up for missed tests.

IMPORTANT: if an unexpected technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the timing or weighting of the labs and assessments.

V COURSE POLICIES

- Communication with instructors
 - We note that if you have a science question, please consider asking your question during class or lab sessions, during student hours, or posting on the lab discussion where your classmates can benefit from the question and answer(s).
 - Students may contact the lecture instructor via email (rebecca.jockusch@utoronto.ca) and may address her as “Rebecca,” or as Prof./Dr. Jockusch if you feel more comfortable with that. Please include your full information, including student number, on any emails. Rebecca generally does not read email on the weekends, but otherwise she will try to respond within 24-hours.
 - Students may contact the lab coordinator via email (david.stone@utoronto.ca). Please include your full information, including student number and laboratory section on any emails.

- 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.

Privacy language and appropriate use of course materials: see **COPYRIGHT**

- In the event of missed labs, students may be given the opportunity to perform the same experiment with another group on a different day, at the discretion of the lab coordinator. Each case will be considered individually.

- All lab work will be submitted electronically through Quercus. Students are responsible for uploading files in the required format ahead of the due date and should **not** rely on the system to auto-submit their work. In case of difficulties, students should contact the lab coordinator and their TA by email immediately.
- Students wanting to have a lab report regraded should request an appointment with the lab coordinator to discuss this. All such requests will be considered on an individual basis.
- **Penalties for late assignment submissions:** If you know ahead of time that a lab assignment will be late, please discuss this with the appropriate instructor. The standard penalty is 5% per day.
- **Missing tests:** Please inform Prof. Jockusch as early as possible if you are unavailable during a scheduled assessment time. Alternate sitting of the test may be arranged. Students who are unable to take a test due to illness or other personal circumstances should contact Prof. Jockusch as soon as possible. Oral assessments with the instructor may be used to replace missed tests.

VI TECHNOLOGY REQUIREMENTS

While we anticipate that lectures and labs will be held in person this semester, there is a possibility that online accessibility (e.g., synchronous lectures via Zoom) to some components may become available, depending on health concerns.

- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: <https://www.vicereprovooststudents.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/>
- 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

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.**

On 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/).

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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 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.

- Students registered with Accessibility Services are strongly advised to make an appointment with the lab coordinator to discuss their situation and plan accordingly to ensure academic success. Please note that instructors are provided **no** information about accommodations other than that they exist.

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 [Quercus Support](#)

ACKNOWLEDGEMENT OF TRADITIONAL LANDS

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.