



## CHM317S: Introduction to Instrumental Methods of Analysis

Course Syllabus – Winter 2024

### I TEACHING TEAM

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**INSTRUCTOR:**

Name: Aaron Wheeler

Email: [aaron.wheeler@utoronto.ca](mailto:aaron.wheeler@utoronto.ca)

Office: Lash Miller Building (80 St. George Street) Room 629

Student hours: in office, Mon, Wed 3:00PM – 4:00PM\*

**LABORATORY INSTRUCTOR:**

Name: David Stone

Email: [david.stone@utoronto.ca](mailto:david.stone@utoronto.ca)

Student hours: during laboratory sections or upon request\*

\* Student hours will typically be in person, but can be delivered online on an *ad hoc* basis – contact to schedule this when needed

### II COURSE OVERVIEW

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**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:**

At the end of this course, 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):**

Prerequisites for this course include CHM217(Introduction to Analytical Chemistry), as well as Calculus I and II (e.g., MAT 135 & MAT 136).

**READINGS:**

*Principles of Instrumental Analysis*, Skoog, Holler and Crouch 6<sup>th</sup> Edition (Thomson & Brooks/Cole) or 7<sup>th</sup> Edition (CENGAGE Learning)

**COURSE WEBSITE:**

The most detailed and up-to-date information about the course is posted on the course website, which can be found by logging in to your Quercus account at <https://q.utoronto.ca>. You are advised to check the course website often, as content (summarized below) will be updated regularly.

- Syllabus and Course Schedule
- Announcements
- Lecture Notes
- Problem Sets and Keys
- Old Tests and Keys
- Laboratory Materials
- Term Tests and Keys

### III COURSE ORGANIZATION

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**LECTURES:**

Lectures are held on Mondays and Wednesdays from 2:00 – 3:00 PM Eastern Time Zone in Sidney Smith Hall (100 St. George Street) Room 2107 (Mon) and the Health Sciences Building (155 College Street) Room 108 (Wed), beginning on Jan. 8<sup>th</sup> and ending on Apr. 3<sup>rd</sup>. A tentative schedule of lecture topics (with readings) is posted on the course website, as well as a complete set of lecture notes. Lectures are divided into three units, which will be covered chronologically: (I) introduction to instrumental analysis and optical spectroscopy (Jan), (II) optical spectroscopy methods (Feb), and (III) mass spectrometry and separations (Mar-Apr). Each unit is linked to a term test or a final exam to assess understanding and mastery of the material.

**LABORATORIES:**

The laboratory component of the course begins with an orientation session (Jan 8, 9, or 10, 10 AM - noon Eastern Time Zone) in the Analest Laboratory in Lash Miller (80 St. George St.) Room 9, followed by weekly meetings throughout the semester – see the course website for details for your particular lab group and schedule. The goal of the laboratory component is to provide you with practical experience in using instrumental methods for chemical analysis. You will, in addition, have opportunities to develop and demonstrate key transferrable skills such as: collaboration, communication (primarily written), data analysis and interpretation, and safe working practices. Finally, you 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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### MARKING SCHEME & DATES/TIMES:

Your final mark in this course comes from two term tests and a final exam (together, 60%) and the collective mark from your laboratory exercises (including lab reports and other assessments) (40%). Each test/exam has (nominally) the same 'weight' or 'importance.' But because anyone can have a bad day (and can make a bad mark on that day), the scores will count toward your final mark as 25% - test/exam with your highest score, 25% - test/exam with your second-highest score, 10% - test/exam with your lowest score. **Record the term test dates/times in your calendar now, as there will be no "make ups" offered!** (See details below.)

Assignment (weight)	Date and Time (all times Eastern)
Term Test 1 (10% or 25%)	Wednesday Jan 31, 6:00 – 8:00 PM, Exam Centre (255 McCaul Street) Room 300
Term Test 2 (10% or 25%)	Monday March 4, 6:00 – 8:00 PM, Exam Centre (255 McCaul Street) Room 300
Final Exam (10% or 25%)	Date (after final lecture) TBD, Time TBD, Place TBD
Laboratory (40%)	See course website

### TERM TESTS AND EXAM:

The term tests and exam will be given "in person" and will each cover one unit of material from the lectures. These exercises will be "closed book," but all relevant equations and constants will be provided. The best way to prepare for these exercises is to work the posted problem-sets and/or the copies of old tests/exams and to be sure that you understand the answers. (Keys are provided for these materials.) Failure to participate in the term tests or the exam will result in a grade of 'zero'; the only acceptable excuse is an illness or other medical emergency, as addressed below. In such cases, there will be no "makeup assignments"; the instructor will work with you to determine a fair reapportionment of the other marked materials.

## V COURSE POLICIES

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### GENERAL:

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 instructor will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wishes 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, you are encouraged to reach out to the staff in the university's Equity Offices.

## **EXPECTATIONS:**

Each member of this course is expected to maintain a:

- professional and respectful attitude during all course activities, including lectures, tests/exams, laboratory exercises, and online activities
- 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

## **LABORATORY POLICIES**

Laboratory procedures and policies are described in detail in the lab manual, which is available on the course website.

## **ARTIFICIAL INTELLIGENCE**

The use of generative artificial intelligence tools or apps for assignments in this course, including tools like ChatGPT and other AI writing or coding assistants, is prohibited. Thus, the knowing use of generative artificial intelligence tools, including ChatGPT and other AI writing and coding assistants, for the completion of, or to support the completion of, an examination, term test, assignment, or any other form of academic assessment, may be considered an academic offense in this course. Likewise, representing as one's own an idea, or expression of an idea, that was AI-generated may be considered an academic offense in this course. Finally, students may not copy or paraphrase from any generative artificial intelligence applications, including ChatGPT and other AI writing and coding assistants, for the purpose of completing assignments in this course. This course policy is designed to promote your learning and intellectual development and to help you reach course learning outcomes.

## **ABSENCES:**

In-person lectures will not be recorded. You are advised to attend them, but attendance is not required. If an absence is unavoidable, lecture notes and discussions with classmates and/or the instructor can help you catch up. Participation in laboratory exercises is mandatory and if an absence is unavoidable, may be made up upon consultation with the instructor. The only excusable absence from a term test or the final exam is an illness or other emergency. In such a case, ***before the day of the test/exam***, you must (i) inform the instructor by email or other means, and (ii) declare the absence using the methods outlined by the faculty of arts & science: <https://www.artsci.utoronto.ca/current/academics/student-absences> (which can include the absence declaration tool in ACORN, a U of T VOI form, and others –see the website for details). In such cases, there will be no "makeup assignments" or credit awarded for "late" submissions; instead, the instructor will work with you to determine a fair reapportionment of the other marked materials.

## **VI TECHNOLOGY REQUIREMENTS**

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This course requires the use of computers, and technical challenges are possible. When completing 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. 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/>, and advice for students more broadly regarding online learning is available here: <https://onlinelearning.utoronto.ca/getting-ready-for-online/>.

## VII INSTITUTIONAL POLICIES & SUPPORT

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### **ACADEMIC INTEGRITY:**

You are encouraged to discuss course content and to work problem-sets and old tests with your classmates. ***However, the lab reports, the two term tests and the final exam must be completed by you and you alone, according to the university's policies on 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 (<https://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:

- Using someone else's ideas or words without appropriate acknowledgement
- Submitting your own work in more than one course without the permission of the instructor
- Making up sources or facts
- Obtaining or providing unauthorized assistance on any report
- Using websites (such as Chegg.com) to post course material/questions/answers
- Looking at someone else's answers or collaborating/discussing during a test
- Misrepresenting your identity
- Falsifying institutional documents or grades
- 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 <https://www.academicintegrity.utoronto.ca/>).

### **COPYRIGHT:**

If a student wishes to copy or reproduce course notes or other course materials (outside of standard use for course activities), 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://library.utoronto.ca/copyright/remote-instruction-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 the [Accessibility Services](#) department as soon as possible. But please be aware that the Accessibility Services department is by law prohibited to share specific details with course instructors. Thus, we strongly recommend that students also contact the laboratory instructor directly as soon as possible to discuss specific needs and what can be done to accommodate them.

**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. Students must inform the instructor *well before the assignment date* to arrange accommodations.

**ADDITIONAL SERVICES & SUPPORT:**

- 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:**

The Teaching Team acknowledges the 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.