DEPARTMENT OF CHEMISTRY UNIVERSITY OF TORONTO MISSISSAUGA

CHM1103
Advanced Topics in Analytical Chemistry
Course Outline - Winter 2025

Class Location & Time	Mon, 12:00 PM - 01:00 PM DH 2080 Wed, 11:00 AM - 01:00 PM MN 3160
Instructor	Alana Ogata
Office Location	SB4016
Office Hours	Wednesdays 1:00 - 2:30 PM, in person SB 4016 and online (zoom link provided on Quercus page)
E-mail Address	alana.ogata@utoronto.ca
Course Web Site	https://q.utoronto.ca/courses/287609

Course Description

An overview of both recent and fundamental developments of instrumentation that are revolutionizing the field of analytical chemistry, with an emphasis on applications in biological chemistry and biotechnology. Topics will include a survey of advanced analytical techniques, including specialized mass spectrometry techniques, x-ray photoelectron spectroscopy, Auger electron spectroscopy, Electron Microscopy, Surface Enhanced Raman spectroscopy, Localized surface plasmon resonance, total internal reflection fluorescence methods; chemometrics, and other state-of-the-art analytical methods. Course work will include independent review of peer-reviewed literature, scientific writing, and student oral presentations

Prerequisite: CHM311H5
Recommended: JCP321H5 (SCI)
Distribution Requirement: SCI

Course Learning Outcomes

On successful completion of the course, you will be able to:

1. Provide an account of advanced methods and instrumentation for advanced anaytical topics
2. Describe and discuss the major topics of chemometrics.
3. Perform basic function in in Python for chemometrics analysis
4. Describe the principles of electrochemistry
5. Explain the operational principles of X-ray photoelectron spectroscopy (XPS) instrumentation and discuss methods and factors of significance to the meaningful interpretation of XPS spectra.
6. Describe the principles of electron microscopy including scanning and transmission electron microscopy
7. Discuss the properties of light at an interface, absorption and scattering processes and advanced spectroscopic techniques that rely on these phenomena.
8. Access, select, critically read, interpret and evaluate scientific literature.
9. Create a thoughtful, seminar-style, oral presentations on operating principles of an advaned analytical method and describe and discuss its application in a recent scientific journal article.
10. Ask meaningful questions following presentations (*e.g*. about specific content, future directions, other applications and technologies that may be possible or more well suited for a given application, *etc.*) and perform effective peer assessments.
11. Apply knowledge of advanced analytical instrumentation to social justice

Assessment and Grading

Type	Description	Due Date	Weight
Presentations	Proposal Presentation	On-going	20%
Assignment	Chemometrics Assignment	2025-02-05	10%
Presentations	Seminar Discussion/Presentations	On-going	20%
Class Participation	Peer Assessment Exercise	On-going	15%

Assignment	Social Justice Activity	On-going	10%
Term Test	Term Test 2	2025-04-02	20%
Class Participation	In-class quizes	On-going	5%
		Total	100%

Midterm Tests

The term tests will take place during regularly scheduled seminar/lecture periods. The term test will be written in-person, consistent with the mode of course deliver indicated in the UTM Timetable at the time of course registration. The specific building information and room number(s) will be announced at a later time. There may be a switch to online test writing in the event that a switch to online course delivery is mandated. Detailed instructions on how to access and complete online term tests will follow *via* the course Quercus site should such an event manifest.

Procedures and Rules

Missed Term Work and Tests, Late Penalties, Absence Declarations, and Petitions for Special Consideration

Penalties for all term work missed or otherwise submitted late is as described in the text that follows unless valid and documented reasons exist for special consideration. Students may submit a petition for special consideration **within one week** of the due date of the missed item of term work or date of the missed test.

The ACORN absence declaration system may be used once per term, to declare an absence of up to seven consecutive calendar days (including days both before and after the date of submission), without requiring medical or other documentation. Provide the Course Instructor with a confirmation of this declaration (e.g. a screenshot) in your petition for special consideration, which contains your name, student number, absence dates, and confirmation number. For more information on the ACORN absence declaration process, and to access the form, see here.

In all other cases (beyond the above-described once-per-term declaration), documentation is required. In all cases, petitions for special consideration should be based on illness or other extenuating circumstances, which are beyond one's reasonable control. Note that reasons such as vacations, family events, wedding attendance, lack of preparation, technology failure, extra-curricular commitments, and academic work in other courses are not considered to constitute extenuating circumstances beyond a student's reasonable control. Absences for reasons of illness should be documented using the U of T Verification of Student Illness or Injury form; please complete this form, have it signed by the appropriate professional (*e.g.* a medical doctor), and send a copy to the course instructor. If not for reasons of illness, your petition for special consideration must contain supporting documentation, which can include a U of T Verification of Extenuating Circumstances form, automobile collision or police reports, a death certificate, and supporting documentation from employers, lawyers and other professional persons. Supporting documents can be submitted electronically as an attachment in your e-mail to the Course Instructor. These attachments can include screenshots, photographs, and/or scans of physical documents. Please ensure the electronic documents are legible and also ensure that you retain the original copies of all documents submitted in case you are asked to present them later. The supporting documentation included in your petition must specify the exact period that you were unable to complete your term work or term test for it to be considered. The Course Instructor will inform the student by e-mail (as per the Communications Policy herein) whether special consideration is granted following due diligence on the documentation provided. Note that false statements and/or documentation will be treated as academic offences and handled accordingly.

If a student misses a midterm test, a mark of **zero (0%)** will be assigned unless a petition for special consideration is made and granted by the Course Instructor. In the case that special consideration is granted, the mark value of the missed test will be re-assigned to a i) make-up oral or written test that will be scheduled at the earliest mutually convenient time for the Course Instructor and student or ii) an assignment on the topic to be covered by the test/assignment or iii) another item of term work, as per the discretion of the Course Instructor.

The penalty for late submission of term work (*e.g.* laboratory reports, assignments, *etc.*) is **a 2% deduction in the final mark per hour within the first 12 hours late of a deadline and a 10% deduction in the final mark per day** that the work is late. A late penalty may be waived provided that a petition for special consideration is made and granted as described above.

Re-evaluation Requests

Requests for re-evaluation of an article of term work (e.g. test, assignment, laboratory report, etc.) must be made in writing **within 1 month** of the return of the article of term work and include a brief explanation as to why the request is being made. Term work submissions can be written in pencil; however, re-marking of term work written in pencil is not permitted. Similarly, articles of

term work on which correction media has been used will be exempt from re-evaluation. Re-evaluation requests must be made to the same person that did the initial grading of the article of term work (normally, this is a Teaching Assistant). Note that the final mark assigned to a re-evaluated article of term-work may go up or down based on the outcomes of re-evaluation (in whole or in part, at the discretion of the marker). Disputes in grading subsequent to re-evaluation by the original marker may be brought forward to the Course Instructor for final adjudication. You, as a UTM student, have the right to appeal a mark beyond the Course Instructor only if the term work in question is worth at least 20% of the course mark.

Laboratory Safety Training

N/A

Laboratory Conduct: Expectations, Roles, and Responsibilities.

N/A

Communications Policy

Students are welcome and encouraged to meet with the Course Instructor during the posted office hour(s). Office hours will be held in person unless online course delivery is mandated. In this event, details for connecting to office hours via Zoom will be posted on the course Quercus site. Note that virtual office hour visits will not be recorded. Visits outside of the regularly scheduled office hour(s) can be made by appointment. Correspondence by e-mail is also acceptable. In all e-mail correspondence regarding this course, please note the following:

1. Please send e-mail only from your @utoronto.ca or @mail.utoronto.ca account.
2. In the Subject line of your message, please include the course code and a brief description of the topic, e.g. "[Course code] - Request for an appointment regarding potentiometry".
3. Please include your full name and student number in all correspondence.
4. Please consult the course syllabus and course website before sending questions by e-mail

I will endeavour to respond to e-mail within two workdays at the latest. Students are responsible for all information posted to the course Quercus site and e-mails sent by the Course Instructor, Laboratory Technicians and Teaching Assistants.

Student Technology Requirements and Connection Tools

During times when a switch from in-person to online course delivery is mandated, Zoom will be used for remote course delivery (*i.e*. lectures, tutorials, and practicals) and office hours. Students are therefore expected to review and be in compliance with the University of Toronto's requirements for online learning and to register for a UTM Zoom account prior to the first course meeting. Students are also strongly encouraged to familiarize themselves with the resources available on the UTM Library's Learn Anywhere website.

Privacy and Use of Course Materials

All course materials belong to the Course Instructor, the University, and/or other sources (depending on the specific facts of each situation) and are protected by copyright. In this course, you are permitted to download materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the Course Instructor. In the event of a mandated switch to remote course delivery, this course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation, and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

Information Security Risks

If you are a citizen of another country, and/or accessing your courses at the University of Toronto from a jurisdiction outside of Canada, please note that you may be subject to the laws of the country in which you are residing, or any country of which you have citizenship. The University of Toronto has a long-established commitment to freedom of expression, with this right enabled by an environment valuing respect, diversity, and inclusion. In your classes, you may be assigned readings, or discuss topics that are against the law in other jurisdictions. I encourage you to become familiar with any local laws that may apply to you and any potential impact on you if course content and information could be considered illegal, controversial, or politically sensitive. If you have any concerns about these issues, please contact your instructor directly to discuss with them

Academic Integrity

UTM wishes to remind students that they are expected to adhere to theCode of Behaviour on Academic Matters regardless of the course delivery method (*i.e.* in-person or online). Potential academic offences include, but are not limited to:

- Using or possessing an unauthorized aid or aids or to obtain unauthorized assistance in any academic examination or term test or in connection with any other form of academic work. Use of unauthorized aid(s) and unauthorized assistance

includes working collaboratively, in-person or online, with others on assessments that are expected to be completed individually, in addition to accessing unauthorized resources (search engines, chat rooms, Reddit, *etc.*) for assessments completed online.
- Representing as one's own, any idea or expression of an idea or work of another in any academic examination or term test or in connection with any other form of academic work, *i.e.* to commit plagiarism.
- Submitting, without the knowledge and approval of the instructor to whom it is submitted, any academic work for which credit has previously been obtained or is being sought in another course or program of study in the University or elsewhere;
- Submitting any academic work containing a purported statement of fact or reference to a source which has been concocted.

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.

Normally, students will be required to submit their course essays to the University's plagiarism detection tool 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 tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

Students are permitted opt-out of using the University's plagiarism detection tool and notice of this decision must be delivered to the Course Instructor no later than the end of day on which the first class meeting occurs. This notice should be provided *via* email, as per the communication policy specified herein. In such a case, you may be asked to submit all of your rough work for an assignment and you may be required to have a short meeting with the Course Instructor to discuss your research methodology.

Academic Rights

You, as a student at UTM, have the right to:

- Receive a syllabus by the first day of class.
- Rely upon a syllabus once a course is started. An instructor may only change marks' assignments by following the University Assessment and Grading Practices Policy provision 1.3.
- Refuse to use the University's plagiarism detection tool (you must be offered an alternative form of submission).
- Have access to your Instructor for consultation during a course or follow up with the Department Chair if the Instructor is unavailable.
- Receive at least one significant mark (15% for H courses, 25% for Y courses) before the last day you can drop a course for H courses, and the last day of classes in the first week of January for Y courses taught in the Fall/Winter terms.
- Submit handwritten essays so long as they are neatly written.
- Have no assignment worth 100% of your final grade.
- Not have a term test worth 25% or more in the last two weeks of class.
- Retain intellectual property rights to your research.
- Receive all your assignments once graded.
- View your final exams. To see a final exam, you must submit an online Exam Reproduction Request within 6 months of the exam. There is a small non-refundable fee.
- Privacy of your final grades.
- Arrange for representation from Downtown Legal Services (DLS), a representative from the UTM Students' Union (UTMSU), and/or other forms of support if you are charged with an academic offence.

Inclusivity Statement

You belong here. The University of Toronto commits to all students, faculty, and staff that you can learn, work, and create in a welcoming, respectful, and inclusive environment. In this class, we embrace the broadest range of people and encourage their diverse perspectives. This team environment is how we will innovate and improve our collective academic success. You can read the evidence for this approach here.

We expect each of us to take responsibility for the impact that our language, actions and interactions have on others. The Department of Chemical and Physical Sciences (CPS) denounces discrimination, harassment and unwelcoming behaviour in all its forms. You have rights under the Ontario Human Rights Code. If you experience or witness any form of harassment or discrimination, including but not limited to, acts of racism, sexism, Islamophobia, anti- Semitism, homophobia, transphobia, ableism and ageism, please tell someone so that we can intervene. CPS takes these reports extremely seriously. You can talk to anyone you feel comfortable approaching, including your professor, teaching assistant, technician, an academic advisor, our Chairs, members of our Equity, Diversity and Inclusivity Committee, or any staff member at our Equity, Diversity & Inclusion Office.

You are not alone. Working together, we can all achieve our full potential.

Course Code of Conduct and Expectations

Each member of this course is expected to maintain:

- A professional and respectful attitude during all course activities, including lectures, labs, and online activity.
- A personal calendar/schedule/organizer to ensure that all course activities are completed and due dates are met.
- Backup copies of all work. Electronic backups should be maintained (ideally in real time) to circumvent technology failures that would otherwise prevent completion of assignments on time. Note that all UofT students are provided with 1 TB of cloud-based storage on the Office365 OneDrive platform (hosted by Microsoft Canada). All students are encouraged to maintain a live backup copy of their work using this secure, cloud-based platform.
- A collection of class notes recorded independently based on concepts covered in lectures and labs (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation).
- Familiarity with the University's policy on Academic Integrity (see: the section entitled Academic Integrity, above, and the Code of Behaviour on Academic Matters).
- Familiarity with the University policy on Conflict of Interest and Close Personal Relationships. Note that a conflict of interest arises when your personal interests conflict with your responsibilities as a student of the University. For example, if you have, or have had, a familial, sexual, or otherwise close relationship with a member of the teaching staff, you will almost inevitably be in a conflict-of-interest situation, which may affect your academic performance. Please disclose any potential conflicts-of-interest to the Course Instructor and/or Department Chair as soon as possible.
- Familiarity with the University policy on Sexual Violence and Sexual Harassment Note that sexual violence is any sexual act or act targeting a person's sexuality, gender identity or gender expression, whether the act is physical or psychological in nature, that is committed, threatened or attempted against a person without the person's consent. All members of the University community should have the ability to study, work, and live in an environment free from sexual violence and sexual harassment.

Equity Statement

The University of Toronto is committed to equity and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect. 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, you may contact the UTM Equity and Diversity officer at edo.utm@utoronto.ca or the University of Toronto Mississauga Students' Union Vice President Equity at vpequity@utmsu.ca.

Accommodations for Learning Needs

The University of Toronto Mississauga supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation, we recommend that students register as soon as possible with Accessibility Services.
Phone: 905-569-4699
Email: access.utm@utoronto.ca

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, lab session, or lecture. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

Mental Health

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. Please note, the University of Toronto (St. George and Mississauga campuses) offer a wide range of free and confidential services that could assist you during these times.

As a CPS student, you have an Academic Advisor who can support you by advising on personal matters that impact your academics. Other resources include:

- Accessibility Services
- Health & Wellness (St. George)
- Health & Counselling Centre (UTM)

- My Student Support Program (MySSP)
- Good2Talk Student Helpline
- Navi

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at My Student Support Program (MySSP) or visiting the Feeling Distressed webpage.

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 the Mississaugas of the Credit. 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.

Other Information

Group Presentations: Journal Club

Students will be assigned to groups and permitted to select a topic of interest covered in Advanced Topics in Analytical Chemistry and a related recent peer-reviewed research article to present on. The topics are selected in hopes of demonstrating that you have the knowledge and skills to understand state-of-the-art research being done in academic laboratories and in industry, and the ability to communicate this information to your peers.

Students will work groups of 2 (or 3 only if needed). Each group will choose a topic to present on, choice of your topic will be decided during the first week of the course in class based on a first-come basis. Each group is expected to give a 15- minute presentation on their topic including an overview of the relevant theory, technology/instrumentation, applications, a summary of one cutting-edge recent peer-reviewed journal article (published between 2022-2024), and future directions. Students are required to survey the literature to find a high impact journal article to summarize (also known as presenting a journal-club style talk), teaching the class about the cutting-edge advancements in the field. Journal articles should be a primary source, not a review article. Students must send Professor Ogata 2-3 choices for a journal paper for approval, at least 2- weeks prior to their presentation date. Professor Ogata will approve one journal paper to present on.

Group presentations are scheduled for Mondays, during regular seminar sessions. The Declaration of Equal Participation (included on the last page of the syllabus), signed by all participating group members, must be provided to the Course Instructor by the end of the day of the presentation. Marks will be awarded to only those students named on the declaration. It is the responsibility of each student to ensure their name is (deservingly) included on the declaration.

Each student must also upload a copy of their group presentation to Quercus in either PowerPoint (*i.e.* .pptx) or Portable Document File (*i.e.* pdf) format in order for presentation marks to be assigned.

The student audience, as part of their class participation peer assessment mark, will grade the presentations and submit at least 1 question per presentation. Rubrics and forms will be provided during the course for the peer assessment by the course instructor.

The Course Instructor, in assigning a presentation grade to the presenters, will take into consideration the student evaluations. However, and for added clarity, the Course Instructor will be the one assigning the presentation grade based on their own assessment of the presentation (*i.e*. it is not baed on the average of peer evaluation scores).

The rubric is taken from the following study, https://pubs.acs.org/doi/pdf/10.1021/acs.jchemed.0c01470 , which showed that use of structured evaluation and reflection resulted in improved oral communication skills. Peer Assessments will be submitted via a Microsoft teams form that is provided during the presentations and will be due by end of day of the presentation (*i.e.* 11:59 PM Monday). The score sheets will include a section for student evaluators to write down their questions for the presenters. As mentioned above, the submitted score sheets will in turn be evaluated as a component of each student's peer assessment mark; which will consider attendance and the appropriateness of the grades issued by the student evaluator and the quality of the comments and questions recorded. The quantity and quality of questions posed by student evaluators to their peers during the question period at the end of each presentation will also be considered as a component of each student's peer assessment mark

In-class Quizes:

Throughout the term, there will in be in-class activities in the form of quizes to prepare students for term tests. In class quizes will be marked for completion of the activity only and will be designed so that students can practice test their knowledge in a low-stakes setting. The in-class activity may include: i) an individual quiz completed independently for each student, ii) a collaborative quiz done in groups of 2, iii) self or peer assessment of in class quizes, iv) review, discussion, and questioning on a peer reviewed journal article.

Term tests:

Term tests will be held in person and include testing of course knowledge through one or more of the following: i) questions on course content, ii) problems associated with real-world applications, iii) problem solving questions, and/or iv) review, discussion, and questioning on content from a peer reviewed journal article. The term tests may also include : i) an individual test completed independently for each student and/or ii) a collaborative test component done in groups of 2, detailed instructions will be provided by the course instructor before the date of each term test.

Declaration of Equal Participation

We agree to and represent by our signatures affixed herein that the CHM414 Presentation entitled

" " and

provided in tutorial on the day of_____was prepared through the collaborative and equal efforts of the following individuals:

Student Name (Printed) Student Signature Date

Student Name (Printed) Student Signature

Last Date to drop course from Academic Record and GPA is March 10, 2025.