



**COURSE INSTRUCTOR:**

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**LAB TECHNOLOGISTS:**



**OFFICE HOURS:** See course syllabus on onQ

## Course Information

### General Course Information

Course: CHEM 397, CHEM 398, CHEM/ENCH 399

Course title: Experimental Chemistry II (Integrated Chemistry Laboratory)

Pre-requisites: : Prerequisite CHEM 222/3.0 and CHEM 223/3.0 and 6.0 units of CHEM at the 200-level.

Corequisite 6.0 units of CHEM at the 300-level. Exclusion CHEM 398/3.0; CHEM 399/3.0.

Semester and year: Fall 2023 and Winter 2024

Learning hours: 300 (144 Laboratory, 12 Tutorial, 144 Private Study)

Modality: On campus

### Course Description

CHEM 397 F/W (CHEM 398 F, plus CHEM/ENCH 399 W) is a laboratory course introducing modern experimental methods in synthetic organic, inorganic, and biological chemistry, physical and computational chemistry, material science and analytical chemistry. Integration of several experimental methods is emphasized in the synthesis, chromatographic separation, and spectroscopic characterization of various chemical species. This course offers the students a unique opportunity to gain valuable hands-on skills working with scientific instruments and techniques commonly used in many academic and industrial laboratories.

### Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Develop critical skills necessary for the analysis of original experimental data by applying established theoretical concepts in Chemistry and related disciplines
2. Formulate scientific reports based on the critical evaluation of available theoretical and experimental data
3. Perform complex lab procedures independently or with little supervision to implement various chemical reactions in organic/inorganic synthesis and catalysis
4. Perform complex chemical separation and purification steps for subsequent compound characterization studies



5. Perform compound and material characterization studies using common spectroscopic techniques, such as  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR, ATR- and DRIFT-IR, UV-VIS and fluorescence spectroscopy
6. Perform qualitative and quantitative chemical analysis using instrumental detection techniques based on gas- and liquid chromatography
7. Using specialized software, e.g.: Gaussian 03, apply basic methods in computational chemistry to evaluate fundamental chemical and physical properties of chemical compounds
8. Perform extensive literature studies using online resources to identify and get access to published information pertaining to various fields of Chemistry and related disciplines

### Course Website

Students registered in this course can access the **OnQ** course space online from: [Queen's onQ](#).

The course site contains the following information:

- Course syllabus, required and recommended materials, tutorial and quiz information
- Your grades
- Lab-related information, including safety, administration and report requirements, the lab schedule, detailed marking outlines, lab videos, Lab TA notes
- TA contact information

**Tutorial: One hour tutorial sessions will be conducted weekly either in-person [REDACTED] or, if announced, as MS Teams remote meetings.**

Attendance of all tutorials is mandatory. Quizzes on studied tutorial material will be conducted as 'take-home' exercises (Quiz 1-4) or in-person tests (Quiz 5 '*Spectroscopic Identification of an Unknown*').

NOTE: No final examination will be held. To pass this course, each conducted tutorial quiz must be passed, *i.e.*: your marks for each quiz must be greater than 50%.

**Laboratory: Two three-hour lab sessions weekly as schedule [REDACTED]**

CHEM 397 students will complete 18 two- or three-session lab experiments; CHEM 398 and CHEM 399/ENCH 399 students will complete 9 labs in each term.

### Course Grading Scheme

Laboratory: (18 reports for CHEM 397, 9 reports for CHEM/ENCH 398/399) **70%**

Tutorial Quizzes: (5 quizzes, including the final quiz '*Spectroscopic Identification of an Unknown*') **30%**

Your course grade will be based on your individual marks for all completed labs and quizzes. Depending on the lab complexity and duration, individual lab marks will range from 5-7% of the total lab grade (70%).

*The tutorial component will include 'take-home' exercises on practical aspects of using scientific literature resources and interpretation of spectroscopic data (10.5% of the total grade for four quizzes) and the '*Spectroscopic Identification of an Unknown*' quiz (19.5% of the total grade), which will be held during the last scheduled lab session).*

To pass this course, you must pass each lab and tutorial quiz.



All components of this course will receive numerical percentage marks. The final grade will be derived by converting your numerical course average to a letter grade according to the Queen's official grade conversion scale.

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

### Lab Format, Attendance, and Lab Evaluation Policy

1. CHEM 397, CHEM 398 and CHEM/ENCH 399 lab experiments will be carried out in-person in pre-assigned lab groups, according to a 'rotating' lab schedule printed in this Laboratory Manual and posted on the course OnQ site. Your experiment schedule will be defined by your lab group number, which you should obtain during the Introductory session for your specific lab section). Students must attend all labs scheduled for their lab group. If a lab is missed due to extenuating circumstances, the student may be able to perform the missed work with a different lab section (conditional to the equipment and TA supervision availability). **Permission of the course instructor is required for any lab work with the alternate lab section. Please inform the TA in your lab section and course instructor as soon as possible about any expected problems with lab attendance and scheduling.**
2. Each 3<sup>rd</sup> year lab experiment may take **two or three lab sessions** to complete, as scheduled. You will be expected to work on all aspects of lab experiments in your initially assigned lab group for the duration of this course. If, for any reason, you are unable to collaborate productively with your lab group partner(s), you may be asked to complete your lab reports individually.
3. **Prelabs** and completed **lab reports** must be uploaded on the course onQ site using the experiment-specific Assignment folders. **Lab reports must be submitted within one week after completing the last lab session of each specific experiment.** However, if you experience time/assignment conflicts with different courses, you can submit your report within a 3-days grace period without penalty. Longer accommodations would require an authorization from the Queen's Accommodations Office and must be discussed with the course instructor as soon as possible. Generally, the TAs are expected to grade your lab report within one week after its submission in onQ. Each lab grade will include the Lab Performance component (to be assigned by the TAs at their discretion). The TAs will enter lab grades in the Queen's OnQ database. You are strongly encouraged to discuss any problems with respect to reports



grading or regarding any other aspects of the laboratory evaluation first directly with your TAs and then with the course instructor. Note that lab grades assigned by the TAs are provisional, and the course instructor will finalize all grades at the end of the laboratory period in each term.

4. Acceptable quality lab reports (greater than 50% of the lab grade) will be required for all completed lab experiments scheduled for your lab group. If you fail your first lab report, you will be able to re-write it for a passing grade. **Subsequently failed lab reports will result in the overall failing grade of the entire course.**
5. You are expected to have read the procedures and to understand the reactions and apparatus before starting an experiment. Before you begin an experiment, obtain the TA's approval.
6. If you finish a part of your scheduled lab experiment ahead of time, or in cases where an experimental procedure calls for allowing a reaction to reflux or stand until the next laboratory period, ask your TA for permission to use the time to proceed with the lab further, or to catch up with unfinished earlier experiments (e.g. spectroscopy).
7. This class offers the student a unique opportunity to work with instruments that are commonly used in many research and industrial laboratories. This equipment is very sensitive and not necessarily designed for the multiple-user mode necessary for this class. The instruments are prone to breakdown and expensive to repair. We ask, therefore, that everyone takes good care of the instruments. Cleaning the spills of chemical in the vicinity of the equipment and the instrument itself is especially important. Consult your TA if unsure about the proper cleaning technique for a particular instrument (e.g.: an analytical balance, a sample compartment of a spectrometer, etc.) You will be graded on lab techniques, which involves making sure that the instrument is in the proper condition before, during and after its use. If complaints occur from subsequent groups, you may lose part or all of your lab performance grades.

#### 8. Laboratory Notebooks

Relevant notes should be written for each lab are to be kept in a bound, ruled notebook that makes carbonless copies. You must write a Table of Contents, and all entries in the book are to be made in ink. Handwriting must be neat and legible. Data are to be entered in the notebook at the time they are obtained. None of the original pages should ever be torn out of the notebook, but you will be required to submit the carbonless copies as part of your lab reports. Each page should also give the date the work was done.

#### 9. Lab Performance Grades

Each lab grade will also include the *Lab Performance* component (to be assigned by the TAs at their discretion). When evaluating your Lab Performance, the TAs will consider the following questions:

- ✓ Were the students well prepared for the lab in terms of their understanding of theoretical concepts and experimental techniques employed in the lab?
- ✓ Did the students implement all lab procedures (e.g.: weighing, pipetting, preparing samples/solutions, conducting instrumental measurements, lab cleanup, etc.) with the required care and attention to detail, and hence recorded adequate data?
- ✓ If your experimental data are poor and you struggled doing the lab, e.g.: mishandling samples, cross-contaminating pure solvents and reagents, etc., your lab performance marks could be deducted up to 100%. However, if your lab has been compromised by instrumental problems



unrelated to your conduct (e.g.: software malfunctioning, etc.), your performance marks will not be affected.

Any lab accidents should be reported immediately to the TA or Lab Technologist. Your TAs are authorized to deduct points from your laboratory mark for safety violations or for hiding or failing to report an accident or spill. However, you will NOT be penalized for reporting accidents or spills, even if they caused the problem.

### Late Policy

Late assignments beyond the 3 day grace period (without long-term Considerations or Accommodations) and without approved Considerations or Accommodations for the labs and quizzes will be penalized **5% per day (or part thereof)** that it is late, including weekends, unless arrangements have been made.

Please see the Academic Considerations for Students with Extenuating Circumstances and Accommodations for Disabilities sections of the syllabus for more information.

### Important University Dates

Please visit the [Faculty of Arts and Sciences Sessional Dates website](#) for all academic deadlines.

## Course Materials & Technologies

### Required Course Textbooks

Course Textbooks	For Purchase
Chem 397/398/399 Lab Manual	Chemistry Stores

### Other Required Materials

Resource	For Purchase
Lab coats and lab goggles	Chemistry Stores
Carbon Lab Book	Chemistry Stores

### Calculator Policy

As noted in Academic Regulation 9.2, Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. For this purpose, the only approved and permitted calculator for Arts and Science courses and exams is the **Casio 991 series**.

### Supplemental Materials

Resource
Fessenden, Fessenden and Feist. "Organic Laboratory Techniques"



Pavia, Lampman, Kriz, 5 <sup>th</sup> ed. (or more recent) "Introduction to Spectroscopy" or R.M. Silverstein 'Spectrometric Identification of Organic Compounds', 7 <sup>th</sup> ed
Atkins and De Paula. Physical Chemistry (10 <sup>th</sup> or 11 <sup>th</sup> ed)
Carey and Juiliano. Organic Chemistry (9 <sup>th</sup> or 10 <sup>th</sup> ed.)
Harris. Quantitative Chemical Analysis (8 <sup>th</sup> or 9 <sup>th</sup> ed)

**Educational Technologies, Help, Privacy, and Accessibility**

This course makes use of the following website(s), program(s), and/or application(s) for specific educational use/purposes.

**Privacy:** Be aware that your independent use of the website(s), programs, and/or application(s) used in this course, *beyond what is required*, is subject to their terms of use and privacy policy. You are encouraged to review the applicable privacy statements before using the site. Please see below.

**Accessibility:** Queen's University is committed to developing courses that are accessible. For further information on accessibility compliance of the website(s), program(s) application(s) used in the course, please consult the links below.

Software	Use	Support	Privacy
ChemDraw	Drawing molecular structures	Free download and license for Queen's students. Visit library site for instructions. <a href="#">Queens Library Chemistry Software Guide</a>	<a href="#">Revvity Privacy Policy</a>
Bruker Topspin (or MestreNova)	NMR Processing	Bruker.com - free download and license for students <a href="#">Top Spin Download Site</a> Mestrelab.com – free download but license has to be purchased <a href="#">Mestrenova Download Site</a>	<a href="#">Bruker Privacy Policy</a> <a href="#">MestreLab Privacy Policy</a>



MS Excel and Word, and One Drive	Document preparation, data processing, file sharing	Provided by Queen's	
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### Copyright of Course Material

Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's express consent. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

## Communication

### Questions about the Course and Contacting the Teaching Team

For questions about course outline, learning outcomes, or general course content questions, please contact the course instructor. For questions about specific labs, please contact the Teaching Assistant who is assigned to your lab (as listed on onQ). For questions about the tutorials or quizzes, please contact the tutorial Teaching Assistant (as listed on onQ).

### Queen's Email

The university communicates with students via Queen's email. Please check your email regularly to ensure you do not miss important information related to your course.

### Course Feedback

At various points during the course, you may be asked to take part in a variety of feedback activities, such as surveys and questionnaires. This feedback enables the teaching team to improve the course. All surveys are anonymous and are directly related to activities, assessments, and other course material.

## Policies

### Academic Support

All undergraduate students face new learning and writing challenges as they progress through university: essays and reports become more complex; effectively incorporating research into writing becomes more important; the types of assignments become more diverse; managing your time and developing the skills you need to read and think critically gets more challenging. I encourage students to contact Student Academic Success Services (SASS). SASS offers many different ways to receive support:



- Free online or in-person [appointments](#) to get personalized support on writing and academic skills from expert staff and trained peers.
- [Workshops](#) and [drop-in programs](#). SASS' [Events Calendar lists events coming soon](#).
- [Online resources](#) that provide strategies for academic skills and writing development at university.
- If English is not your first language, SASS has specific resources for [English as Additional Language students](#), including weekly programs and EAL academic skills appointments. You can meet on an ongoing basis with an EAL consultant to work on your academic writing, speaking, listening, and reading skills.

### **Accommodations for Disabilities**

Queen's University is committed to working with students with disabilities to remove barriers to their academic goals. Queen's Student Accessibility Services (QSAS), students with disabilities, instructors, and faculty staff work together to provide and implement academic accommodations designed to allow students with disabilities equitable access to all course material (including in-class as well as exams). If you are a student currently experiencing barriers to your academics due to disability related reasons, and you would like to understand whether academic accommodations could support the removal of those barriers, please visit the [QSAS website](#) to learn more about academic accommodations or start the registration process with QSAS by clicking **Access Ventus** button at [Ventus | Accessibility Services | Queen's \(queensu.ca\)](#)

VENTUS is an online portal that connects students, instructors, Queen's Student Accessibility Services, the Exam's Office and other support services in the process to request, assess, and implement academic accommodations.

To learn more go to: <https://www.queensu.ca/ventus-support/students/visual-guide-ventus-students>

### **Academic Consideration for Students in Extenuating Circumstances**

Academic Consideration is a process for the University community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to,

- Short term Physical or Mental Illness or Injury (stomach flu, anxiety/depression, mononucleosis, concussion, broken bones, surgery, medical treatments, etc.)
- Traumatic Event/Confidential (Bereavement, serious injury, illness or required treatment for a significant other/family member or a traumatic event such as divorce, sexual assault, social injustice, etc.)
- Requirements by Law or Public Health Authorities (court dates, jury duty, requirements to isolate, etc.)
- Significant Event (varsity athletic event, distinguished event, serving in the Reserve Forces, etc.)





Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances. For more information, please see the [Senate Policy on Academic Consideration for Students in Extenuating Circumstances](#).

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. For more information, undergraduate students in the Faculty of Arts and Sciences should consult the Faculty's webpage on [Academic Consideration in Extenuating Circumstances](#) and submit a request via the [Academic Consideration Request Portal](#). Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their instructor and/or course coordinator as soon as possible once academic consideration has been granted. Any delay in contact may limit the options available for academic consideration.

For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see the Faculty of Arts and Science's [Academic Consideration website](#). ASO courses include links to information on **Academic Consideration** on your **Course Homepage** in onQ.

### **Queen's Policy Statement on Academic Integrity**

Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge, and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Queen's students, faculty, administrators and staff therefore all have responsibilities for supporting and upholding the fundamental values of academic integrity. Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility and by the quality of courage. These values and qualities are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University.

The following statements from "The Fundamental Values of Academic Integrity" (2nd edition), developed by the International Center for Academic Integrity (ICAI), contextualize these values and qualities:

1. **Honesty** Academic communities of integrity advance the quest for truth and knowledge through intellectual and personal honesty in learning, teaching, research, and service.
2. **Trust** Academic communities of integrity both foster and rely upon climates of mutual trust. Climates of trust encourage and support the free exchange of ideas which in turn allows scholarly inquiry to reach its fullest potential.
3. **Fairness** Academic communities of integrity establish clear and transparent expectations, standards, and practices to support fairness in the interactions of students, faculty, and administrators.
4. **Respect** Academic communities of integrity value the interactive, cooperative, participatory nature of learning. They honor, value, and consider diverse opinions and ideas.
5. **Responsibility** Academic communities of integrity rest upon foundations of personal accountability coupled with the willingness of individuals and groups to lead by example, uphold mutually agreed-upon standards, and take action when they encounter wrongdoing.



6. **Courage** To develop and sustain communities of integrity, it takes more than simply believing in the fundamental values. Translating the values from talking points into action -- standing up for them in the face of pressure and adversity — requires determination, commitment, and courage.

Students are responsible for familiarizing themselves with and adhering to the Senate [regulations](#) concerning academic integrity, along with [Faculty or School](#) specific information. Departures from academic integrity include, but are not limited to, plagiarism, use of unauthorized materials, facilitation, forgery and falsification. Actions which contravene the regulation on academic integrity carry sanctions that can range from a warning, to loss of grades on an assignment, to failure of a course, to requirement to withdraw from the university.

### **Syllabus statements for Generative Artificial Intelligence (AI) Tools**

Using generative AI writing tools such as ChatGPT in your submitted work is not permitted in this class. This type of use constitutes a Departure from Academic Integrity.

Original work, completed wholly by you, is expected to be submitted in this course. The use of an artificial intelligence tool like ChatGPT is not permitted.

Queen's [Student Academic Success Services](#) (SASS) offers a self-directed, online academic integrity module which we encourage all students to take which will help with:

- Understanding the nature of the academic integrity departure
- Understanding the expectations of and role of sources in scholarly writing
- Integrating sources into your writing (paraphrasing, quoting, summarizing)
- Understanding when and how to cite your sources
- Managing your time effectively to avoid the need for shortcuts
- Taking effective notes to ensure accuracy of source material and correct attribution

### **Turnitin Statement**

This course makes use of Turnitin, a third-party application that helps maintain standards of excellence in academic integrity. Normally, students will be required to submit their course assignments through onQ to Turnitin. In doing so, students' work will be included as source documents in the Turnitin reference database, where they will be used solely for the purpose of detecting plagiarized text in this course. Data from submissions is also collected and analyzed by Turnitin for detecting Artificial Intelligence [\(AI\)-generated text](#). These results are not reported to your instructor at this time but could be in the future.

Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. The similarity report generated after an assignment file is submitted produces a similarity score for each assignment. A similarity score is the percentage of writing that is similar to content found on the internet or the Turnitin extensive database of content. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process.



Please read Turnitin's [Privacy Policy](#), [Acceptable Use Policy](#) and [End-User License Agreement](#), which govern users' relationship with Turnitin. Also, please note that Turnitin uses cookies and other tracking technologies; however, in its service contract with Queen's University Turnitin has agreed that neither Turnitin nor its third-party partners will use data collected through cookies or other tracking technologies for marketing or advertising purposes.

For further information about how you can exercise control over cookies, see [Turnitin's Privacy Policy](#).

Turnitin may provide other services that are not connected to the purpose for which Queen's University has engaged Turnitin. Your independent use of Turnitin's other services is subject solely to Turnitin's Terms of Service and Privacy Policy, and Queen's University has no liability for any independent interaction you choose to have with Turnitin.

*Portions of this document have been adapted, with permission, from the University of Toronto Centre for Teaching Support and Innovation tip sheet "[Turnitin: An Electronic Resource to Deter Plagiarism](#)".*

## Inclusion

### Land Acknowledgement

The territory that Queen's University occupies is included in the Dish with One Spoon Wampum Belt Covenant, an agreement between the Iroquois Confederacy and the Confederacy of the Ojibwe and Allied Nations to peaceably share and care for the resources around the Great Lakes. The Kingston Indigenous community continues to reflect the area's Anishinaabek and Haudenosaunee roots. There is also a significant Métis community as well as First Peoples from other Nations across Turtle Island present here today.

### Equity, Diversity, and Inclusivity Statement

Queen's University recognizes that the values of equity and diversity are vital to and in harmony with its educational mission and standards of excellence. It acknowledges that direct, indirect, and systemic discrimination exists within our institutional structures, policies, and practices and in our community. These take many forms and work to differentially advantage and disadvantage persons across social identities such as race, ethnicity, disability, gender identity, sexual orientation, faith, and socioeconomic status, among other examples. In this class I will work to promote an anti-discriminatory, anti-racist and accountable environment where everyone feels welcome. Every member of this class is asked to show respect for every other member.

### Building a Classroom Community

University is a place to share, question, and challenge ideas. Each student brings a different set of lived experiences. You can help to create a safer, more respectful classroom community for everyone by following these guidelines:

- Make a personal commitment to learn about, understand, and support your peers.
- Assume the best of others and expect the best of them.
- Recognize and value the experiences, abilities, and knowledge each person brings to the course.



- Acknowledge the impact of oppression on other people's lives and make sure your words and tone are respectful and inclusive.
- Encourage others to develop and share their ideas.
- Pay close attention to what your peers say/write before you respond. Think through and re-read what you have written before you post online or send your comments to others.
- Be open to having your ideas challenged and challenge others with the intent of facilitating growth.
- Look for opportunities to agree with one another, building on and intentionally referencing peers' thoughts and ideas; disagree with ideas without making personal attacks, demeaning, or embarrassing others.