



Experimental Chemistry II (Integrated Chemistry Laboratory)

COURSE INSTRUCTOR:

Prof. Igor Kozin

Office: Chernoff Hall 124

Phone: 613-5336000 x74665

E-mail: igor.kozin@chem.queensu.ca

LAB TECHNOLOGISTS:

Fall Term - Mr. Lyndsay Hull (email: lyndsay.hull@queensu.ca)

Winter Term - Mr. Tom Hunter (email: tom.hunter@queensu.ca)

OFFICE HOURS:

11 AM to 12 PM, Wednesdays, *contact MS Teams or by email*

COURSE DESCRIPTION

CHEM 397 F/W (CHEM/ENCH 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 research and industrial laboratories.

INTENDED STUDENT LEARNING OUTCOMES

Upon completion of this course, the students will be able to:

- Develop critical skills necessary for the analysis of experimental data in comparison to established theoretical concepts in Chemistry and related disciplines
- Formulate scientific reports based on the critical evaluation of available theoretical and experimental data
- Perform complex lab procedures independently or with little supervision to implement various chemical reactions in organic/inorganic synthesis and catalysis
- Perform complex chemical separation and purification steps for subsequent compound characterization studies
- Perform compound and material characterization studies using common spectroscopic techniques, such as ^1H - and ^{13}C -NMR, ATR- and DRIFT-IR, UV-VIS and fluorescence spectroscopy
- Perform qualitative and quantitative chemical analysis using instrumental detection techniques based on gas- and liquid chromatography
- Using specialized software, e.g.: Gaussian 03, apply basic methods in computational chemistry to evaluate fundamental chemical and physical properties of chemical compounds
- Perform extensive literature studies using online resources to identify and get access to published information pertaining to various fields in fundamental and applied Chemistry, and related disciplines

COURSE WEBSITE

Students registered in this course will make extensive use of the online course material, which is accessible from the Queen's *onQ* site. Login to *onQ* at: <https://onq.queensu.ca> and proceed to the [CHEM 397 / CHEM/ENCH 399 Experimental Chemistry II F/W 20/21 course homepage](#).

The course site contains the following information and resources:

- Course material, including syllabus, tutorial and final exam notes
- Your grades
- Lab-related information, including safety, administration and report requirements, *lab schedule* and detailed *marking outlines* for all laboratory experiments

- Lab description for each specific experiment and associated instructional material, including links to videos.
- Original experimental data for lab report compilation - the students will be expected to download, process and analyze it as instructed in each specific lab.
- TA contact information.

TUTORIAL & QUIZZES:

Both for the Fall 2020 and Winter 2021 semesters one-hour tutorial sessions will be held remotely as MS *Teams* meetings according to the *Fall Semester CHEM 397 Tutorial Schedule* (accessible from the course onQ site). Tutorial attendance is mandatory, quizzes on studied tutorial material will be required.

The Tutorial Schedule for the winter semester will be posted in onQ in due time.

LABORATORY:

Generally, during the fall and winter semester labs CHEM 397 students will be required to complete eighteen two- or three-session lab experiments. For CHEM/ENCH 399 students, only nine lab experiments must be completed.

Fall 2020 Lab Format:

CHEM397 Fall 2020 Labs will be implemented using the remote access format. All remote lab sessions will be conducted as online *Microsoft Teams* meetings twice per week, according to the Fall 2020 Lab Schedule posted on the course onQ site. CHEM 397 students will be expected to **work collaboratively** on all aspects of remote labs **in lab groups (pairs).** Using the course onQ site, during the first week of classes, each CHEM 397 student shall sign up for a lab group with an available lab partner of their choosing. The lab group number in each lab section will in effect define the schedule of all experiments for each particular lab group (see the onQ posted lab schedule). Therefore, barring unforeseen circumstances, student lab groups must be kept unchanged for the duration of the entire course, both in the fall and winter semesters.

All fall semester remote lab sessions (MS *Teams* meetings) will be conducted by the Lab TAs with a limited number of student lab groups/ in accordance with the Fall 2020 Lab Schedule. Generally, these 1 -1.5 hr (or less, depending on available pre-recorded instructional videos) 'remote-access' labs will be comprised of a number of activities, such as (e.g.):

- Live lab Intro by the TAs (lab purpose and scope, including chemical concepts and reactions studied, lab techniques and instrumental characterization methods/equipment employed, major procedure steps, etc.;
- The TAs may show examples of or refer to pre-recorded video material on (e.g.): sample preparation, general lab techniques and specific reactions. These videos will be accessible from onQ;
- The TAs may show examples of the instrument setup as well as experimental runs and data storage using the screen-sharing function of MS *Teams*, or refer to pre-recorded video material (accessible from onQ);
- The TAs will explain what kind of experimental data are available for each specific lab). The TAs may also show some examples of *data processing* or refer you to the related pre-recorded videos.
- The students will be expected to download and process the original experimental data, which will be made accessible for each lab from the course onQ site and to compile a **formal lab report** for their lab group. Lab reports must be uploaded for evaluation in onQ using the *lab-specific assignment folders* within **one week** after completing the last lab session for each scheduled experiment.

Winter 2021 Lab Format:

CHEM 397 and CHEM/ENCH 399 labs in the winter 2021 semester are planned to be implemented as 'regular' (hands-on) three-hour lab sessions held twice per week in *Chernoff Hall* (room 120 – 122 and NMR facility).

LAB ATTENDANCE POLICY

All CHEM 397, CHEM/ENCH 399 lab experiments must be attended as scheduled for your lab section and your initially selected lab group/pair. In order to pass this course, **all scheduled lab experiments must be completed, and acceptable quality written lab reports must be uploaded on the onQ course site**. Please note that if a lab cannot be completed at the scheduled time, it is the students' responsibility to notify their TA and the lab coordinator at an earliest possible opportunity.

In exceptional circumstances, e.g.: due to illness, compassionate reasons, etc., if a scheduled lab experiment cannot be completed at the assigned time, the lab report submission deadline may be extended. Contact your lab TAs and Lab Coordinator as soon as possible to make appropriate provisions.

In addition, the following considerations will be given:

- The lab may only be completed during the current academic year. A mark of **INCOMPLETE** for the course will be assigned until the missing work has been completed. The instructor will submit a change of grade form once all experiments have been completed.
- In rare circumstances, other accommodations may be made at the discretion of the lab coordinator, in consultation with the course instructor.

GRADING SCHEME

Laboratory (18 reports for CHEM 397, 9 reports for CHEM/ENCH 398/399):	65%
Tutorial and Quizzes:	10%
Final exam (practical lab or remote access format):	25%

Your course grade will be based on labs, quizzes and final exam marks. Depending on the lab duration (two- or three-session labs) and lab complexity, individual lab grades will range from 5 to 7% of the total lab grade (65%).

Student lab group presentations and individual Q&A sessions:

Instead of a full formal *Lab Report*, for one of the selected labs in both semesters (see below), each student lab group will be expected to prepare and present a short (10 to 15 min, 5 to 10 slides) PowerPoint/Keynote presentation describing the lab objective, experimental methods employed, the discussion of experimental results, and brief conclusions.

Labs selected for presentations and Q&A sessions:

Fall Semester Labs:

Exp. C (groups 1 to 10), Exp. K (groups 11 to 17)

Winter Semester Labs:

Exp. J (groups 1 to 18)

Detailed marking schemes for student presentations can be accessed online from the course website.

LAB REPORT REQUIREMENTS

Pre-labs must be completed individually and uploaded as pdf-formatted files in onQ (see Assignments/Lab #) for each lab experiment scheduled for your lab group. Detailed guidelines for prelab can be found on the course onQ site (see Content/Lab Administration and General Requirements).

Lab reports must be uploaded for evaluation in onQ as pdf-formatted files using the lab-specific assignment folders (see Assignments/Lab #) within **one week** after finishing all remote lab sessions of a given experiment. Each lab must include a *pre-lab* section (to be done individually) and a *full formal lab report* submitted by a lab team (pair). **You should work on your lab reports collaboratively, and both partners will be considered responsible for all sections of the submitted report, irrespective of how the actual work was divided.** Please note that Individual students may be asked to write their own lab reports, if they consistently failed to collaborate with their lab group partners. You must also upload your *calculations* and compiled data plots as MS Excel spreadsheet file(s), and/or other material in accordance with the lab instructions and as requested by Lab TAs.

Please note that **late report submissions** may be penalized: up to 20% of the total possible report mark may be deducted for each working day late.

CHEM 397, CHEM/ENCH 399 lab reports will be graded according to detailed lab-specific grading outlines posted in onQ. Generally, the Lab TAs will grade student reports on-line using 'Turnitin' integrated with onQ. The total lab grade (prelab plus lab report) and TAs' Turnitin comments will be entered on the course OnQ site for students to review. In order to get a passing grade for the lab component and hence the course, your submitted reports must be of sufficient quality, i.e. better than 50% of the total lab grade. In addition, both the lab component and final exam must be passed in order to pass this course.

For any questions and clarification, make sure that you interact with your lab TAs via *Teams* and by *email*. You can also contact the Lab Coordinator for any unresolved concerns as related to report grading or regarding any other aspects of the CHEM/ENCH 213 labs.

In the case of hands-on lab sessions conducted in the undergraduate lab space in Chernoff Hall, 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. The TAs will deduct points (5% of the current experiment) if they notice that you are not wearing goggles when you should be wearing them. However, you will NOT be penalized for reporting accidents or spills, even if they caused the problem.

Lab Performance Grades (for 'regular' hands-on labs only, winter 2021): Each lab grade will include an individual *lab performance* mark. When evaluating your lab performance, the TAs will take into consideration the following aspects:

- ✓ Is the student well prepared for the lab in terms of his/her understanding of theoretical concepts and experimental techniques employed in the lab?
- ✓ Did the student implement all lab procedures with the required care and attention to detail, and hence recorded adequate data?
- ✓ If your experimental data were poor and you struggled doing the lab, e.g.: mishandling samples, cross-contaminating pure solvents and reagents, etc., your 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.

Final Examination:

The final exam will be scheduled individually at the end of the fall semester (CHEM 397), or at the end the winter semester (CHEM/ENCH 399). The exam content and format will be discussed in full detail in the pre-exam tutorial.

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

REQUIRED COURSE MATERIALS

Resources/Tools

- A desktop or laptop **computer** (Win10 or Mac) will be required for conferencing and collaborative online work, for reviewing literature and video instructional material, as well as for data processing, analysis, and report compilation.
- **Fast internet connection strongly recommended** (40 MB/s or greater). You will be expected to work online using Queen's OneDrive, and *onQ*, so a connection to internet will be quite essential.
- **Webcam** for remote lab and tutorial Teams meetings (integrated or USB-connected) **recommended.**
- **General Software (required):** MS Teams desktop app; MS Office, including Excel, Word and PowerPoint; please also install. You would probably also require PowerPoint or KeyNote for an online presentation.

- **Professional Software (required):** *MarvinSketch* for chemical structure drawing and analysis (chemaxon.com, free download, request a free license); NMR software - Bruker *Topspin* (bruker.com, free to download and use), or *MestReNova* (mestrelab.com, free download, purchased license required). For Windows PCs, could use SpinWorks (inferior compared to TopSpin or MNOVA).

Literature

- **Recommended textbooks:** Pavia, Lampman, Kriz (*Introduction to Spectroscopy*, 5th ed or more recent - same as used in CHEM 222), Atkins (Physical Chemistry), Carey (Organic Chemistry, 7 ed or more recent), Fessenden (Organic Laboratory Techniques).
- All lab experiments will require access to Queen's Library e-journals for online literature search and various scientific papers specific to each particular lab experiment.

Winter-term hands-on labs held in Chernoff Hall will require approved face masks, lab goggles, lab coats, pants and closed-toe shoes to be worn at all times.

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 **Cassio 991 series**.

Academic Integrity

Queen's students, faculty, administrators and staff all have responsibilities for upholding the fundamental values of academic integrity; honesty, trust, fairness, respect, responsibility and courage (see www.academicintegrity.org). These values 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 (see the Senate Report on Principles and Priorities <http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities>).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and their behaviour conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1>), on the Arts and Science website (see <https://www.queensu.ca/artsci/students-at-queens/academic-integrity>), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Please note that we have had issues in the past with unintended plagiarism in this course. Regardless of how and where you retrieve information, the principles of academic integrity apply. Please visit these helpful websites to help you make sure that you are able to write things in your own words:

- <https://www.queensu.ca/academicintegrity/students/avoiding-plagiarismcheating>
- <https://integrity.mit.edu/handbook/academic-writing/avoiding-plagiarism-paraphrasing>
- http://writing.wisc.edu/Handbook/QPA_paraphrase.html

Copyright of Course Materials

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.

Notice of Recording

Synchronous (live) lab sessions and tutorials will be delivered in this course through a video conferencing platform supported by the University [MS Teams, Zoom]. Steps have been taken by the University to configure these platforms in a secure manner. Classes will be recorded with video and audio (and in some cases transcription) and will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen's University, please see the general [Notice of Collection, Use and Disclosure of Personal Information](#).

Accommodations with Disabilities

Queen's University is committed to achieving full accessibility for people with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016 (see

<https://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslclwww/files/files/policies/senateandtrustees/ACADACCOMMPOLICY2016.pdf>). If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the **Queen's Student Accessibility Services (QSAS)** and register as early as possible. For more information, including important deadlines, please visit the QSAS website at: <http://www.queensu.ca/studentwellness/accessibility-services/>

Academic Consideration for Students in Extenuating Circumstances

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time. The Senate Policy on Academic Consideration for Students in Extenuating Circumstances is available at:

<http://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslclwww/files/files/policies/senateandtrustees/Academic%20Considerations%20for%20Extenuating%20Circumstances%20Policy%20Final.pdf>

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. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the portal where a request can be submitted at: <http://www.queensu.ca/artsci/accommodations>. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

Because of the course complexity and logistical constraints, the students should discuss any academic considerations for this course directly with the course instructor at the earliest possible opportunity.

If you need to request academic consideration for this course, you will be required to provide the name and email address of the instructor/coordinator. Please use the following:

Instructor/Coordinator Name: **Prof. Igor Kozin**

Instructor/Coordinator email address: *igor.kozin@chem.queensu.ca*