



COURSE OUTLINE

1. **Course:** CHEM 515, Advanced Instrumental Analysis - Fall 2021

Lecture 01: MWF 09:00 - 09:50 - Online

Instructor	Email	Phone	Office	Hours
Dr Hans Osthoff	hosthoff@ucalgary.ca	403 220-8689	SB 205	online, by appointment

In Person Delivery Details:

Lab: In person

Details, including the experiment schedule and due dates of laboratory reports, are given in the laboratory manual posted on D2L. Note that no in-person labs will take place during (or after) the oral examination period (see below).

Re-Entry Protocol for Labs and Classrooms:

To limit the spread of COVID-19 on campus, the University of Calgary has implemented safety measures to ensure the campus is a safe and welcoming space for students, faculty and staff. The most current safety information for campus can be found [here](#). **Online Delivery Details:**

Some aspects of this course are being offered in real-time via scheduled meeting times. For those aspects you are required to be online at the same time.

To help ensure Zoom sessions are private, do not share the Zoom link or password with others, or on any social media platforms. Zoom links and passwords are only intended for students registered in the course. Zoom recordings and materials presented in Zoom, including any teaching materials, must not be shared, distributed or published without the instructor's permission.

Lecture: Hybrid format (some synchronous components).

Lecture content will be primarily distributed via video modules posted on the course's D2L web site. Students are expected to have watched these videos and review any assigned readings prior to each class.

The class time (MWF 9:00-9:50 am) will be used for activities to reinforce students' learning. Attendance of synchronous components is highly recommended and will include some graded components (see section 3 for details). Students must use their U of Calgary email account to sign in to the synchronous course components (i.e., Zoom). To facilitate discussion and dialogue for group work, students are encouraged to have a photograph or image of their face as their "profile picture" and to turn on their webcam or camera (at least when speaking). Note that in-class components will not be recorded.

Oral examination:

20-minute oral exams will be individually booked during the scheduled laboratory periods Nov 30 to Dec 3 and Dec 6 2021. Scheduling will take place prior to the Fall Break. For the oral exam, students will be required to turn on their webcam or camera (see <https://elearn.ucalgary.ca/technology-requirements-for-students/>) and to produce their student i.d., if requested. Students are not permitted to stream, broadcast, or record their oral exams.

Office hours:

Office hours will be held via Zoom or Microsoft Teams by appointment (in small groups or individually) and may also be scheduled on D2L. Note that students are encouraged to turn on their webcam or camera (see <https://elearn.ucalgary.ca/technology-requirements-for-students/>) and may be asked to enable remote control of their screen (e.g., when seeking help with software) for office hours.

Students may also contact the instructor via email (hosthoff@ucalgary.ca). Email inquiries will be responded to within 48 hours except on weekends, holidays, or during the Fall Break.

Course Site:

D2L: CHEM 515 L01-(Fall 2021)-Advanced Instrumental Analysis

<https://d2l.ucalgary.ca/d2l/home/401286>

Note: Students must use their U of C account for all course correspondence.

2. Requisites:

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Chemistry 311/315.

3. Grading:

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %	Date
Laboratory (see lab manual for details)*	60%	see D2L
Midterm exam I	10%	Wednesday Oct 13, 2021 (online, synchronous, during class time)**
Midterm exam II	10%	Friday Nov 19, 2021 (online, synchronous, during class time)**
Synchronous in-class activities***	5%	see D2L
Oral examination (via zoom)	15%	during scheduled laboratory periods, Nov 30 - Dec 3 and Dec 6, 2021

* Students will be required to complete 6 laboratory experiments and maintain a rigorous laboratory notebook. Students are required to calculate concentrations of all of their assigned unknowns and write a minimum of two formal laboratory reports (outside scheduled laboratory time). For details, see the lab manual posted on D2L.

** In-class midterm exams are designed to allow for **40-minutes of writing time**, with an additional *10-minute buffer time* to account for unexpectedly technical difficulties. Writing time will be adjusted for SAS students if needed. As well, accommodations for students facing a significant barrier to writing the assessment during the scheduled time will be done on a case-by-case basis and consider, e.g., different time zones, caregiving responsibilities, ability to secure an appropriate test-taking environment. Students who need accommodation for the midterm exams must contact Dr. Osthoff at least 1 week in advance of the scheduled assessment or immediately after a change in circumstance.

*** Students will be required to complete 8 out of 9 possible worksheets (~1 / week except during weeks when midterms are scheduled) posted on D2L during the synchronous in-class activities (usually on Fridays). Please upload completed worksheets to the corresponding dropbox on D2L. Students will be assigned to small groups during class and may hand in a single worksheet per group for full credit. In case a student misses the synchronous activity, they may, individually, complete and submit the missed activity worksheet within 48 hours of the in-class activity for credit, or request an extension within 48 hours. Grading will either be 100% for complete worksheets handed in or 0% for worksheets not completed.

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	90 %	85 %	80 %	76%	72%	68 %	64 %	60%	55%	50 %	45 %

This course does **not** have a registrar scheduled final exam.

Laboratory reports submitted for grading are required to be in "portable document format" (.pdf).

Late penalties: 10% of the grade will be deducted for each 24-hr period term work is submitted after the posted deadline, unless **prior** approval by the course coordinator was granted. Any work submitted later than 2 weeks after the posted deadline will not be considered for marking.

The University of Calgary offers a [flexible grade option](#), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not

eligible, please visit the following website: <https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade>

4. **Missed Components Of Term Work:**

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, one possible arrangement is that the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course. This option is at the discretion of the coordinator and may not be a viable option based on the design of this course.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Required Textbook(s):

R.M. Granger et al., *Instrumental Analysis University of Calgary Custom Edition*: Oxford University Press.

The textbook is available for purchase at the University Bookstore (www.calgarybookstore.ca)

There are 3 versions available for purchase:

- the hardback, full version (~\$240)
- a paperback, University of Calgary custom print edition (~\$75). Note that used versions from previous years are acceptable.
- an e-text version, available for rent or purchase at from several online retailers, including VitalSource

While all graded assignment questions will be provided directly to students, students will find similar worked examples in this textbook along with supporting readings, making it a core resource for this course.

RECOMMENDED TEXTBOOKS:

- "Principles of Instrument Analysis", D.A. Skoog et al., Brooks Cole, 6th ed. (2006); Cengage 7th ed. (2018).
- "Building Scientific Apparatus", J.H. Moore et al., Cambridge University Press, 4th ed. (2009).
- "Quantitative Chemical Analysis", D.C. Harris, Freeman, 9th ed. (2016) or 10th ed. (2020).
- "Communicating Science: An Introductory Guide", R. Jensen, RoguePublishing.ca (2016).

SOFTWARE:

In this course, students will be using **Microsoft 365** aka Office (e.g., Word, Excel, Teams and Onenote) and Zoom, which are provided through the University of Calgary's site license.

In addition, students will be downloading a trial version of **Wavemetrics Igor 6.37** at <https://www.wavemetrics.com/software/igor-pro-637-installer>, which, unfortunately, is not supported on new, 64-bit or ARM Apple computers. Students with Apple computers should download Igor 8.04.

The software activation code will be released once students agree to the the licensing conditions by completing a D2L 'quiz'. The conditions are stated below.

1. The software may be used only by students and only for assigned course work.
2. It may not be used for research.
3. The serial name and activation key may not be shared.
4. The software must be removed once course work has been completed at the end of term.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

7. Examination Policy:

All examinations are "open-notes" and "open-book", i.e., the use of any of handwritten notes, the laboratory manual, the laboratory notebook prepared by the student, the required course text (including the e-text version), or any other printed reference text is permitted. The use of internet resources and any form of communication with a third party are not permitted.

For the oral exam, students will be required to turn on their webcam or camera (see <https://elearn.ucalgary.ca/technology-requirements-for-students/>) and to produce their student i.d., if requested. Students are not permitted to stream, broadcast or record their oral exams.

Students should also read the Calendar, [Section G](#), on Examinations.

8. Approved Mandatory And Optional Course Supplemental Fees:

There are no mandatory or optional course supplemental fees for this course.

9. Writing Across The Curriculum Statement:

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

10. Human Studies Statement:

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

11. Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Services:** For more information, see www.ucalgary.ca/wellnesscentre or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (syasa@ucalgary.ca) or phone at [403-220-2208](tel:403-220-2208). The complete University of Calgary policy on sexual violence can be viewed at (<https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-Violence-Policy.pdf>)
- d. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic

integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)
Student Academic Misconduct [Policy](#) and [Procedure](#)
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

e. Academic Accommodation Policy:

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the [Request for Academic Accommodation Form](#) and sending it to Dr. Yuen-Ying Carpenter by email yyscarpe@ucalgary.ca preferably 10 business days before the due date of an assessment or scheduled absence.

f. Freedom of Information and Privacy: This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.

g. Student Union Information: [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: sciencerep@su.ucalgary.ca. [Student Ombudsman](#), Email: ombuds@ucalgary.ca.

h. Surveys: At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

i. Copyright of Course Materials: All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

Course Outcomes:

- Describe how concentrations are converted to analytical signals in common instrumental analysis methods, including GC-FID, GC-MS, HPLC, IC, AAS, ICPMS, UV-VIS, and Fourier Transform instruments.
- Describe the design and function of components in common instrumental analysis methods, such as light sources and detectors, monochromators, mass analyzers, data acquisition, pumps, temperature and pressure measurements, and injectors, columns and detectors used in chromatography.
- Identify common interferences and artifacts such as isobaric interferences in ICP-MS, causes of non-linear response in spectrophotometers, impacts of co-elution in chromatography, and how these might be avoided or minimized.
- Analyze data using calibration curves, linear regression analysis, and curve fitting, and to be able to calculate

confidence intervals, limits of detection and quantification, using software as appropriate.

- Apply fundamental concepts of electronics, including common electronic components, analog filtering using RC circuits, voltage dividers, and the role and basic function of operational amplifier to data acquisition.
- Explain how to optimize signal-to-noise ratios and apply techniques such as signal modulation & lock-in amplification and post-data acquisition digital filtering.
- Analyze inorganic and organic samples using modern analytical instrumentation in laboratory experiments.

Electronically Approved - Sep 01 2021 15:39

Department Approval

Electronically Approved - Sep 01 2021 16:13

Associate Dean's Approval