



## COURSE OUTLINE

### 1. **Course:** CHEM 515, Advanced Instrumental Analysis - Fall 2022

Lecture 01 : MWF 09:00 - 09:50 in MS 211

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

To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

#### **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).

##### **Lecture:** In person

Flipped class room approach: The 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 have reviewed 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. In-person attendance is highly recommended and will include some graded components (see section 3 for details). Note that in-class components will neither be broadcast on zoom nor recorded.

#### **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:**

This course is being offered online in real-time via scheduled meeting times, 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.

#### **Oral examination:**

20-minute oral exams will be individually booked during the scheduled laboratory periods in SA-168 Nov 30, Dec 1-2, and Dec 5-6, 2022. Scheduling will take place at least 7 days prior to the exams. 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 students must use their U of Calgary email account to sign in to Zoom or Teams and 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).

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

#### **Course Site:**

D2L: CHEM 515 L01 - (Fall 2022) -Advanced Instrumental Analysis

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

### Equity Diversity & Inclusion:

The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

The Chemistry EDI Committee acknowledges there are persistent barriers that prevent such accessibility and hinder our progress towards EDI. Our representatives (faculty, postdocs, graduate and undergraduate students) are committed to addressing any concerns and work towards proactive solutions that enact necessary change within the department. To submit anonymous questions, comments or concerns regarding EDI related issues, please reach out to our Associate Head EDI, Belinda Heyne ([bjmheyne@ucalgary.ca](mailto:bjmheyne@ucalgary.ca))

### 2. Requisites:

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

#### Prerequisite(s):

Chemistry 311/315.

As per the recommended course sequence posted on <https://www.ucalgary.ca/student-services/degreetguide/science/chemistry>, it is recommended to have taken Statistics 327 or Statistics 205 prior to Chem 515.

### 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:

Course Component	Weight	Due Date (duration for exams)	Modality for exams	Location for exams
Laboratory <sup>1</sup>	60%	Ongoing		
Oral examination <sup>2</sup>	15%	Ongoing		
Assignments (4) <sup>3</sup>	10%	Ongoing		
Participation <sup>4</sup>	5%	Ongoing		
Midterm	10%	Nov 18 2022 at 09:00 am (50 Minutes)	in-person	In class

<sup>1</sup> Students will be required to complete 7 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.

<sup>2</sup> During scheduled laboratory periods in SA-168, Nov 30, Dec 1, Dec 2, Dec 5 or Dec 6, 2022. Time slots for individual students will be posted on the course's D2L site at least 7 days prior to the exam.

<sup>3</sup> Each assignment is worth 2.5% of the total grade. Assignments will be posted on D2L. Tentative dates are: #1 - posted Sept 16, due Sept 23 #2 - posted Sept 22, due Sept 29 #3 - posted Oct 7, due Oct 14 #4 - posted Oct 28, due Nov 4. Assignments #1 and #2 may be resubmitted (once) for credit.

<sup>4</sup> In-class participation is optional but recommended to enhance your learning. The weight of this grading component will be automatically added to that of the Midterm (if a higher percentage is achieved).

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 and assignments 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](http://www.calgarybookstore.ca))

There are 3 versions available for purchase:

- the hardback, full version (>\$200)
- 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 9**.

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:**

The midterm examination is "open-notes", i.e., the use of handwritten notes or printed notes prepared by the student is permitted. The use of printed reference texts, including the required course text, internet resources, and any form of communication with a third party are not permitted.

For the oral exam, students will be required to produce their student I.D., if requested. The oral exam is "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. 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.

- 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
- 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:**

- 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](#)).
- SU Wellness Services:** For more information, see their [website](#) or call [403-210-9355](#).
- 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 ([svsa@ucalgary.ca](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](tel:403-220-2208). The complete University of Calgary policy on sexual violence can be viewed [here](#).

- 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](#)  
[Faculty of Science Academic Misconduct Process](#)  
[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 Associate Head, Undergraduate by email [ahugchem@ucalgary.ca](mailto:ahugchem@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 (FOIP). 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:** [SU contact](#), Email SU Science Rep: [sciencerep1@su.ucalgary.ca](mailto:sciencerep1@su.ucalgary.ca), [Student Ombudsman](#)
- 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.

### **13. Lab exemptions:**

According to department policy (<https://science.ucalgary.ca/chemistry/current-students/undergraduate/lab-exemptions>), lab exemptions are NOT granted for CHEM 515.

### **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 02 2022 00:07

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**Department Approval**