



COURSE OUTLINE

1. **Course:** CHEM 515, Advanced Instrumental Analysis - Fall 2023

Lecture 01 : MWF 09:00 - 09:50 in SB 105

Instructor	Email	Phone	Office	Hours
Dr. Amanda Musgrove	amanda.musgrove@ucalgary.ca	--	SA 144F	By appointment: http://ow.ly/Lh4F50HeFPn

Please allow up to **2 business days** for a response to questions via email. Check D2L for a schedule of drop-in office hours, and how to book an appointment for in-person or virtual office-hours visits.

Please put **CHEM 515** in the subject line of all emails to get the most accurate response.

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:

All components of this course are completed in-person, during the scheduled course times. Lectures are not recorded or streamed online, and will include a mixture of traditional lecturing and problem-solving activities. Students may be asked to prepare for lecture or lab by watching videos, reading from online sources or the course textbook, or reading provided notes. In these cases, your instructor will try to give at least one week advance notice (on D2L) of the preparatory material.

Course Site:

D2L: CHEM 515 L01-(Fall 2023)-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)

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:

Course Component	Weight	Due Date (duration for exams)	Modality for exams	Location for exams
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Each of the above components will be given a letter grade using the official university grading system (see [section F.1.1](#)). The final grade will be calculated using the grade point equivalents weighted by the percentages given above and then converted to a final letter grade using the official university grade point equivalents.

CHEM 515 will use **specifications grading**, in which your course grade is not solely based on the percentage score you earn on assignments but rather on how many and which assignments you successfully complete. Each assignment is graded according to a rubric that outlines the *specifications* for that assignment. Some information on grading of assignments is provided below the table and full details are on D2L. Due dates for all assessments are available on D2L.

Grades are abbreviated as follows:

- **X** - item not submitted or does not meet minimum criteria
- **NI** - "Needs Improvement": Item meets minimum submission criteria but is not sufficient for a P grade.
- **P** - "Pass": Item meets acceptable standards for that component.
- **HP** - "High Pass": Item meets or exceeds specifications and demonstrates mastery of the component.

Minimum Requirements for each letter grade				
<i>To earn a grade, you must meet all the requirements in that column.</i>				
Component	D	C	B	A
Laboratory components				
Lab Notebook <i>graded twice during term</i>	1 NI	1 P + 1 NI	2 P	1 P + 1 HP
Unknown Analyses <i>7 analyses during term, weekly</i>	3 P + 1 NI	4 P	4 P + 1 HP	4 P + 2 HP
Lab Report Drafts <i>3 reports; spaced through term</i>	1 P + 1 NI	1 P + 1 NI	1 P + 1 NI	2 P + 1 NI
Lab Report Final Submissions <i>3 reports; due at end of term</i>	1 P + 1 NI	2 P	3 P	2 P + 1 HP
Skills Assessments <i>7 assessments, submitted by TA</i>	4 P	5 P	5 P	6 P
Lecture Components				
Assignments <i>4 assignments; every ~3 weeks</i>	2 NI	2 P	3 P	4 P
Quizzes <i>3 quizzes; in-class every 3rd Friday</i>	1 P + 1 NI	2 P + 1 NI	3 P	2 P + 1 HP
Final Exam <i>3h; during final exam period</i>	50%	60%	70%	80%

Determination of + / - grade modifiers and F letter grades:

See D2L for more examples.

- If your work does not successfully meet **ALL** criteria for a D grade, you will earn an F grade.
- If your work exceeds **ALL** criteria for a given letter grade, you will earn a "+" on that letter grade.
For example, grades of "HP" when the requirement is "P", or 4 "P" grades when the requirement is 3.
- If your work does not meet **one** (and only one) criteria for a letter grade, AND meets ALL of the criteria for the next lower letter grade, you will earn a grade of "-" on the higher letter grade.
For example, if all criteria for a grade of "A" are met, except a score earned of 75% on the final exam (does not meet A criteria but does meet all B criteria), a grade of "A-" will be assigned.

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:

In the event that a student legitimately fails to submit any online or in-person assessment on time (e.g. due to illness, domestic affliction, 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, or possible exemption and reweighing of components. Absences not reported within 48 hours will not be accommodated. Students may be asked to provide supporting documentation ([Section M.1](#)) for an excused absence, See [FAQ](#).

If an excused absence is approved, options for how the missed assessment is dealt with is at the discretion of the coordinator or course instructor. Some options such as an exemption and pro-rating among the components of the course may not be a viable option based on the design of this course.

For all scheduled absences (religious observance, medical appointment, varsity athletics, etc), notify your instructor *at least 10 business days prior to the component that will be missed* If you are unable to attend or submit a graded course activity due to an emergency or illness, contact your instructor as soon as possible, *at most 48h after the missed activity or due date.*

There is **no make-up lab section** and ability to schedule alternate labs is very limited. If you are unable to attend your scheduled lab, contact your instructor as soon as possible, following the deadlines above. An accommodation will be arranged **if possible**. Note that it is possible to obtain any available grade in the course having missed one lab (i.e. with one grade of X in the unknown analysis and skills assessment). This will account for most missed lab activities.

If you will miss a **in-class quiz**, contact your instructor as soon as possible, following the deadlines above. An accommodation **on the same day or earlier** will be arranged if possible. If an accommodation is not possible, ONE quiz grade of X can be excused and replaced with your grade on the final exam if approved in advance. You will receive instruction if needed on how your letter grade will be calculated, since the final exam receives a numerical grade (not X/NI/P/HP).

If you will be unable to submit an **assignment, lab notebook, unknown analysis result, lab report draft, or final lab report** by the posted due date for any reason, you may submit **it up to one week after** the posted due date. Submitting late may affect your ability to earn a grade of "HP" on that submission: see individual rubrics on D2L. (Note that grades of HP are not required to earn a particular letter grade for many assignments). Notice of a late submission is NOT required within this week. If an emergency or force majeure is preventing you from making a due date, contact your instructor and it may be possible to arrange an accommodation.

5. Scheduled Out-of-Class Activities:

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

6. Course Materials:

Recommended Textbook(s):

Robert M Grainger II, Hank M Yochum, Jill N Grainger, Karl Seinerth, *Instrumental Analysis*: Oxford University Press.

Other textbook editions and alternate textbooks are acceptable in CHEM 515; however students using other texts are responsible for identifying the relevant course readings in their own book.

Note on textbook format

The textbook is available from the Bookstore in several formats, including a digital edition. Students should note that exams and quizzes in CHEM 515 are open-book, but *paper only*. Electronic resources, including use of an e-text, are not permitted during exams. Anyone wishing to use the e-text should be prepared to print relevant passages or take handwritten notes from the text to bring to exams.

Other required course materials

Students will also need:

- Lab coat (thigh/fingertip length)
- Safety goggles or glasses with side shields
- Hard-covered, permanently bound laboratory notebook
 - You can use the same book as 311/315 if there is enough pages left
- Scientific calculator
- Access to a computer that can run *Igor Pro* analysis software (an educational license will be provided to students at no cost)

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:

Course exams are **open-book (paper only)**. Course notes, textbooks, course assignments, and all material provided on D2L is permitted for use during the exam, as long as it is printed and available offline. Use of electronic resources, including e-text editions, is not permitted during exams or quizzes. A scientific calculator may be used, provided that it does not have communication ability.

All quizzes and exams must be written individually by the student named on the exam paper. Sharing of exam papers, notes, or other communication with others during an exam is not permitted. All quizzes and exams are written in-person during a scheduled time, and must be completed within the scheduled time. Quizzes are scheduled during class time on certain Fridays, and the final exam day and time will be scheduled by the Registrar.

Academic Accommodations and Exams:

Any student with academic accommodations must be registered with Student Accessibility Services (see Section 12(f) below), and have reviewed their accommodations as described on the SAS documents with the course coordinator **within the first 15 days of the semester or at least 10 business days before** any scheduled activity for which accommodations are required. An email confirming mutual understanding of the accommodations will suffice.

Students who wish to use the Exam Centre for writing exams or quizzes are responsible for booking their own writing times.

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 their [website](#) 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 (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. **Student Ombuds Office:** A safe place for all students of the University of Calgary to discuss student related issues, interpersonal conflict, academic and non-academic concerns, and many other problems.
- e. **Student Union Information:** [SU contact](#), Email your SU Science Reps: science1@su.ucalgary.ca, science2@su.ucalgary.ca, science3@su.ucalgary.ca,
- f. **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 preferably 10 business days before the due date of an assessment or scheduled absence.

- g. **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](#)

- h. **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.
- i. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). 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.
- j. **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.

Use of Generative AI and Other Writing Assistance

To document that graded work is substantially the creation of its named author, CHEM 515 has a strict authorship requirement for all submitted work. Full details of this policy, including format and submission requirements, are on D2L.

For all asynchronous written work, including lab report drafts and final reports, students must include a statement of authorship. This statement should include original drafts of work submitted for editing, or generative prompts along with original output for situations where generative AI (also known as LLM (Large Language Models) or just "AI", such as ChatGPT, Bing Chat Assistant, Google Bard, and others) was used. The same policy applies if human editing, translation, or creative services are used on a piece of graded work. These drafts will not be considered for grading; their purpose is solely for verifying authorship.

Submission of work created entirely or substantially by a LLM, generative AI, or related service is not generally acceptable for graded work in CHEM 515. If you are unsure about appropriate authorship of any course assignment, ask your instructor *before* handing in your work.

Laboratory Component of the Course

In-person laboratory activities begin the week of **September 11**.

You must attend only the laboratory section in which you are registered, unless you have been given written permission by the instructor to attend a different section.

It is mandatory that students wear a lab coat and safety glasses at all times when working in the lab, as well as wearing appropriate clothing. Anyone not following these or other safety protocols will not be permitted to enter the lab or conduct experiments. Instructions and safety regulations are in the lab manual and laboratory safety training materials (see below). The course D2L site includes details on how to prepare for the labs and how each lab will be assessed.

Teaching assistants begin each lab with a review of safety precautions promptly at the scheduled lab start time. If students arrive late and miss the safety briefing (typically, after the first 5 minutes), they will not be permitted to enter the lab or conduct experiments. See the lab manual and instructions on D2L for details.

Laboratory Safety Course

All undergraduate students taking chemistry laboratories are required to complete an introductory course (approx. 50 minutes) on laboratory safety. This course is presented in an online format. The Safety Course must be completed before the first laboratory experiment. Students who do not complete the safety lessons will subsequently be denied admission to the laboratories. While it will not count directly to the final grade, the material is considered to be part of the course and is therefore appropriate for inclusion into laboratory pre-labs and exams. Students who have previously completed the Chemistry Safety Course at the University of Calgary in the past five years are NOT required to repeat it.

Laboratory Exemptions

Students who previously completed labs in-person and are repeating the course within the last two years can be exempted from the Laboratory Component of the course if a grade of 75% or higher was obtained on the lab portion. Students choosing to exempt from the lab should be aware that:

- The labs in Fall 2023 may be significantly different from prior labs in this course.
- The material covered in these labs will be integrated into other course assessments.
- Students will still be evaluated on other course components, including tutorials.
- The lab component grade achieved on the previous attempt will be carried forward.

Prior to applying for an exemption, students are encouraged to connect with their course instructor or coordinator to better understand the risks and benefits in their specific course, as well as what access they will (or will not) have to lab materials or feedback as an exempt student. Students can apply for an exemption to the laboratory component at <https://science.ucalgary.ca/usc-lab-exemption-application>. Students joining the course after the deadline of **August 29, 2023** should contact the USC as soon as possible if they wish to apply for an extension.

Note: Online labs completed at any time are not eligible for use as a lab exemption in the in-person Winter 2023 term.

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 - Aug 30 2023 09:29

Department Approval