

CHEM 550 - INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**Lectures: Mon. & Wed. 2:00 - 2:50 pm****Location: GMCS 305****Instructor:** Prof. Christopher R. Harrisonemail: charrison@sdsu.eduOffice hours: By appointment - <https://harrison-sdsu.youcanbook.me>Zoom meeting room: <http://sdsu.zoom.us/my/charrison>

Course Objective: This course will continue to develop your knowledge and understanding of the processes of chemical analysis. The central focus of the course are the central instruments employed for conducting chemical analyses and quantification. The course will develop your understanding of how these instruments operate, how they are able to perform chemical analyses, as well as the strengths and limitations of each analytical approach. By the end of the course students will be able to identify the most appropriate instrument(s) to be employed in a given chemical analysis scenario, and to support their selection.

Expected Student Learning Outcomes:

- Students will be able to identify where chemical analyses are applied, or required, in order to gain knowledge of a complex system.
- Students will be able to describe how the major instrumental techniques are able to perform their respective analyses.
- Students will be able to identify the strengths and weaknesses of each of the major instrumental techniques as they apply to various samples, matrices, and analytes.
- Students will be able to interpret and analyze the data produced by an instrumental technique, and report what information is being provided by the instrument.
- Students will be able to justify their selection of a particular analytical technique, or approach, for the analysis of a complex sample.
- Students will be able to compare different analytical instruments and techniques for their viability to successfully conduct chemical analyses.
- Students will gain perspective on the diversity of scientists working to advance analytical chemistry.

Class format:

This class will be taught as a mixture of short lectures, and time for class/group discussion, as well as group work. There is no set textbook for this course, digital materials will be provided to you via Canvas. Lectures slides will also be posted to Canvas, ideally prior to each class, but you should be prepared to take notes during the lecture portion of the class, as the slides are not comprehensive of all the course material.

Each week of the course will have a group worksheet that you will need to complete. These worksheets will have problems that will get into the theory and application of the materials that I will cover in the class. At the end of each week the problem sets will be collected and graded for completion for each group.

The goal is to allow you a time in class to apply your understanding of the materials that we are discussing so that you can gauge your understanding, and identify what you need to focus your studying on in order to develop your comprehension of the course material.

There will also be periodic homework assignments that will need to be submitted. These will be graded as traditional assignments - correct answers get points. These assignments will help you confirm how well you have understood a particular course topic.

Worksheets:

These will be weekly sets of questions that will build upon the materials covered in class. They are to be completed, and submitted at the end of each week. One submission per group. The problem sets are graded for completion, not accuracy; we will be discussing the answers to the questions in class. Details for submission will be provided through Canvas.

Homework:

Roughly every two weeks there will be a homework assignment. This assignment is to be done individually, and submitted individually. The grade you get on the assignment will be based on how well you answer the individual questions; solutions will be posted after the submission deadline. Details for submission will be provided through Canvas.

Literature Assignment:

For each instrumental technique that we cover in class you will need to do some literature searches to find a research paper that describes a new innovation or application of the instrument to an analytical problem. You will then need to submit a

brief summary of the article that you have found, outlining the novelty of the work. Further details about this assignment will be posted on Canvas.

Exams:

All mid-semester exams (3) will take place in the regular class time in a designated classroom. The exam questions will include calculations and theory. The final exam is scheduled by the university and will be two hours long.

Exam wrappers will be required with each mid-semester exam, as a means of self-assessing your progress and adjusting your study strategies accordingly to ensure that you are developing into the most effective learner you can be.

Grading Plan:

As with any course, the grade that you receive is based upon your demonstrated

| Component | Quantity | Each | Total | % of Total |
|-----------------------|----------|------|------------|------------|
| Worksheets | 12 | 5 | 60 | 13% |
| Literature Assignment | 6 | 5 | 30 | 7% |
| Homework | 6 | 15 | 90 | 20% |
| Mid-semester Exams | 3 | 70 | 210 | 46% |
| Final Exam | 1 | 70 | 70 | 15% |
| Total | | | 460 | |

knowledge of the course material. With this in mind, each graded element of this course will be used to evaluate your mastery of the material. In the table below you will find the point values for each course component.

Grading:

- Your final letter grade will be determined based upon the total number of points you have earned throughout the course. A tentative grade distribution (in percentages) is tabulated on the next page. Note particularly high or low class averages may shift the grade distribution.
- Note: The grading scale is only an example. You are NOT guaranteed the corresponding letter grade for achieving a given percentage grade. Your final letter grade will be influenced by the overall class grade distribution to reflect your rank in comparison with your classmates.

- The Grade Center in Canvas is used to display all your individual grades, it is not used to calculate your final grade, due to the best X of Y nature of some of the grading components. Please use the Grade Center to verify that the correct grade has been entered for your assignments, labs, and exams.

On-Line Material:

- Please ensure that Canvas has your correct/active email address as the Canvas email feature will be frequently used to relay pertinent course information. It is your responsibility to ensure that you are receiving these communications.
- All course materials will be distributed and accessed through Canvas.
- Some course components may be provided through other platforms, such as Google Drive. Links to these items will be provided through Canvas when necessary.

| Letter | Cutoff |
|--------|--------|
| A | 92% |
| A- | 88% |
| B+ | 84% |
| B | 77% |
| B- | 73% |
| C+ | 69% |
| C | 62% |
| C- | 58% |
| D+ | 53% |
| D | 45% |
| D- | 40% |
| F | <40% |

Course Schedule

| Week of | Topic | Assignments | Worksheet | Lit. |
|-------------|--|---|-----------|----------|
| January 15 | Introduction & instrumental measurements | - | #1 | - |
| January 22 | Signals and Noise | Homework #1 | #2 | - |
| January 29 | Spectroscopy | - | #3 | - |
| February 5 | Spectroscopy | Homework #2 | #4 | - |
| February 12 | Spectroscopy | Exam 1 - Wed. Feb. 14th | - | Spec.#1 |
| February 19 | Spectroscopy | - | #5 | - |
| February 26 | NMR | Homework #3 | #6 | - |
| March 4 | NMR | - | #7 | Spec. #2 |
| March 11 | Mass Spectrometry | Homework #4 | #8 | - |
| March 18 | Mass Spectrometry | Exam 2 - Wed. Mar. 20th | - | MS |
| March 25 | Band broadening & Resolution | - | #9 | - |
| April 1 | No class Spring Break | | | |
| April 8 | Gas Chromatography | Homework #5 | #10 | GC |
| April 15 | Liquid Chromatography | - | #11 | LC |
| April 22 | Capillary Electrophoresis | Exam 3 - Wed. Apr. 24th | - | CE |
| April 29 | Electrochemistry | Homework #6 | #12 | - |
| | Cumulative Final Exam | Mon. May 6 1-3 pm | - | - |

** The dates for the exams are fixed, but the exact dates when each topic is covered (and number of classes dedicated to the topic) may vary with the pace of progress through the course materials. Exam materials will be adjusted to reflect the actual materials covered prior to the exam day.*

Absence & Deadline Policies:

- All deadlines are firm and extensions will not be provided on an individual basis.
- Technology failures (e.g. webpages not loading, dog ate my computer, internet being down...) are likely to occur, do not leave the submission of homework or labs to the last minute. No extensions will be provided for such occurrences.
- Unexcused absences for an exam will be treated as a zero. If an excused absence is allowed (e.g. medical reason, conference schedule conflict...) the points value for the exam will be redistributed over the other exams, or an estimate of the likely exam grade will be made based on all other exams taken in the course during the semester (comparing the student's performance to that of all their classmates as a benchmark).

Accommodations:

If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and Dr. Harrison cannot provide accommodations based upon disability until he has have received an accommodation letter from Student Ability Success Center.

Preferred Names & Pronouns

Any student who wishes to be addressed by a name other than what is presented in Canvas is encouraged to contact Dr. Harrison via email with the name you wish to use in this course. Similarly, if you have preferred pronouns that you wish to be addressed by please contact Dr. Harrison.

Dr. Harrison will communicate your desires to the TAs and all instructional staff will gladly honor your request.

Resources for students: A complete list of all academic support services--including the **Writing Center** and **Math Learning Center** is available on the Student Affairs' **Academic Success** website. **Counseling and Psychological Services** (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

SDSU Economic Crisis Response Team: If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit sdsu.edu/ecrt, email ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.

Classroom Conduct Standards: SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
 1. physical abuse, threats, intimidation, or harassment.
 2. sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

Religious observances

According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

Student Privacy and Intellectual Property

The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will use [Canvas / Blackboard] to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.