

Course Information – CHEM-457 – Spring 2025

Class Days: Mon and Wed

Class Times: 8:00-10:40 AM or 11:00-1:40 PM

Class Location: CSL 222

Mode of Delivery: In-person

Instructors:

Dr. Greg Holland, GMCS-213C, gholland@sdsu.edu

Dr. Laura-Isobel McCall, GMCS-213B, use Canvas to email Dr. McCall.

Dr. David Onofrei, NMR Lab (CSL-225), chem-nmr@sdsu.edu

TA's: Davit Alimbarashvili and Ellen Kuang. TAs can be reached via Canvas email.

Prerequisites:

CHEM 251, CHEM 432, CHEM 432L, and credit or concurrent registration in CHEM 410B; concurrent registration in CHEM 550.

Student Learning Outcomes:

In this laboratory course, students will study instrumental methods of chemical separations and molecular analysis frequently used in all disciplines of chemistry. The student successfully completing the course will be able to:

1. Design and carry out chemical experiments for analyte identification and quantification with instruments commonly used in chemistry labs,
2. Learn sample preparation, calibration curve development, standard dilutions, operation of instrumentation, troubleshooting instrumentation,
3. Use instrument software and Excel spreadsheets for graphing, data analysis, and interpretation,
4. Understand the advantages and features of different analytical methods including electronics, laser optics, fluorescence microscopy, gas chromatography, liquid chromatography, mass spectrometry, nuclear magnetic resonance, and optical spectroscopic methods,
5. Use a combination of instrumental methods to determine molecular structures of organic compounds.
6. Prepare presentations describing experimental results obtained in the lab.
7. List three analytical chemists from underrepresented groups and their contributions to the field.

Textbooks (same as those for Chem 550):

Textbooks are not required but you are encouraged to read the relevant chapters to further build your knowledge.

Optional: Instrumental Analysis: Granger, Robert M., Yochum, Hank M., Granger, Jill N., Sienerth, Karl D., 1st Ed., Oxford, 2017; Principles of Instrumental Analysis, Skoog, Holler and Crouch, 7th Ed., Thomson, 2018.

Lab Manuals: Available in Canvas

Required Materials: proper laboratory PPE including safety glasses or lab goggles, laboratory notebook, black Sharpie pen, a scientific calculator, flash drive for data storage, access to MS Excel and a MS Word, and means to upload graphics onto Canvas.

Student Information

- The class size is limited to 18 and you will work in groups of three.
- Every member of a group is expected to work together as a team, participate in all aspects of the experiments, write their own lab reports and upload all work to Canvas.
- Prelab quizzes will be required for some labs. Instructors will update details. There will be no prelab quiz makeups.
- You will need to properly maintain a laboratory notebook and keep it up to date. Electronic notebooks are allowed.
- You must sign a safety release form that states you will comply with all safety requirements of the Chemistry Department and to conduct yourself in a professional manner at all times.
- You will have to complete an online training course on Laboratory Safety to continue in this class.
- PPE will be required for some but not necessarily all lab activities. You must have your own safety glasses or lab goggles for chromatography (LC/GC) experiments. No exceptions.
- No food or open drink containers are allowed in the labs (a space in lab will be provided for storage).
- Everyone will receive two organic compounds as unknowns that you will analyze by multiple analytical techniques. You will prepare a 15 minute oral presentation of each compound to be presented to your class at the end of the semester.
- Lab attendance is mandatory and exceptions, other than health-related, are allowed only in rare cases. Please inform the instructors by email if any unplanned absences have occurred.
- If you have any symptoms of COVID-19, please follow current university guidelines. Guidelines are found at: <https://sacd.sdsu.edu/student-health-services/covid-19>

Course Design: The course consists of three major components: 1) spectroscopy, 2) chromatography and 3) molecular spectroscopy. Each module contains lectures and laboratory works, spanning multiple days. Students are expected to complete quizzes, homework, and laboratory reports of each component. Different groups have different lab schedules and due dates. Carefully review the class schedule table. The group assignment will be announced via Canvas. The class materials presented in the co-requisite course, Chemistry 550, do not stay in synchronous with this lab content, so reading assignments will be provided as needed.

Specific experiments in this course:

- Some Basics on Common Laboratory Techniques
- Spectrophotometric Determination of Copper
- Gas Chromatographic Analysis of Cooking Oils as Fatty Acid Methyl Ester Derivatives
- The HPLC Analysis of Water-Soluble Vitamin Tablets
- Proton and Carbon NMR Data Collection and Techniques
- IR, MS and Other Methods of Sample Identification

In addition to these experiments, there will be in-class discussions on the interpretation of data from NMR, IR and MS analyses, and how to make an oral and written presentation on the structural analysis of organic compounds using these and other techniques.

Awarding of Points

As a laboratory course, there will be an emphasis on grading for the lab experiments. The distribution of points for lab activities is shown on the following table. To pass the course, you must turn in all experiments and have completed the Oral/Written presentation- no exceptions. There is no Final Exam given for this class. Note that you are expected to keep and maintain a Laboratory Notebook. In addition, you are expected to be a team player and keep the laboratory and your work stations, analytical balances, etc. clean. Glassware and equipment you have used must be cleaned and properly put away before you leave the lab for the day. Just to make certain that you have completed the assignment, always check with your Lab Instructor before you leave for the day. To determine your standing in the class at any time, divide the points you have earned by the total possible points attempted.

Lab Activity	Points
Total Points	783.5
Excel basics	7
Pipetting, weighing and concentration preparation	30.5
Spectrophotometric Determination of Copper	45
Chromatography in-class activities	10
Chromatography quiz	20
Pre-lab homework assignments chromatography	34
GC lab report	115
LC lab report	115
MS in-class activities	20

Mass spectrometrists profiles assignment	2
MS Hwk	25
NMR Hwk	75
IR Hwk	25
NMR Quiz	25
IR Hwk Quiz	10
Oral/Written Presentations	200
Participation including Lab etiquette, housekeeping, and Notebook Upkeep	25

Grading Policies:

No exams are given in this laboratory course. Your letter grade for the course will be based on all the grades from your lab reports and quizzes.

All assignments will have set deadlines, and in general, all reports are due one week after the completion of the laboratory work. Deadlines are firm and extensions will not be provided on an individual basis except for illness or in rare cases. In any late submission, a 5% per day late penalty will be applied and no reports will be accepted that are than three weeks late. Technology failures (e.g. webpages not loading, dog ate my flash drive, 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.

The 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 below. Note particularly high or low class averages may shift the grade distribution.

Letter	A	A-	B+	B	B-	C+	C	C-	D	F
Cutoff	94	90	87	84	81	77	74	70	60	<60

Note: The grading scale above is only an example. You are NOT guaranteed the corresponding letter grade for achieving a given percentage grade. Your final grade will be influenced by the overall class grade distribution to reflect your rank in comparison with your classmates.

Course Schedule (tentative):

<u>Week</u>	<u>Date</u>	<u>Instructor</u>	<u>Topic</u>
Week 1	Wed, Jan. 22	Holland	Check-in, introductory materials
Week 2	Mon, Jan. 27	Holland	Pipetting, weighing and concentration preparation

Week 2	Wed, Jan. 29	Holland	Spectroscopic Determination of Copper
Week 3	Mon, Feb. 3	Holland	Lab Report Prep (Work on Copper Report)
Week 3	Wed, Feb. 5	Holland	IR (Lecture + "IR Instrument Show and Tell")
Week 4	Mon, Feb. 10	McCall	Chromatography Review - GC/LC
Week 4	Wed, Feb. 12	McCall	HPLC or GC 1
Week 5	Mon, Feb. 17	McCall	HPLC or GC 2
Week 5	Wed, Feb. 19	McCall	HPLC or GC 3
Week 6	Mon, Feb. 24	McCall	Data Analysis and lab report prep
Week 6	Wed, Feb. 26	McCall	HPLC or GC 1
Week 7	Mon, Mar. 3	McCall	HPLC or GC 2
Week 7	Wed, Mar. 5	McCall	HPLC or GC 3
Week 8	Mon, Mar. 10	McCall	Data Analysis and lab report prep
Week 8	Wed, Mar. 12	McCall	MS1
Week 9	Mon, Mar. 17	McCall	MS2
Week 9	Wed, Mar. 19	Holland	NMR1
Week10	Mon, Mar. 24	Holland	NMR2
Week 10	Wed, Mar.26	Holland	NMR3
Week 11	Mon, Mar. 31	holiday	spring break
Week11	Wed, April 2	holiday	spring break
Week12	Mon, April 7	Holland	NMR4
Week12	Wed, April 9	Holland	NMR5
Week13	Mon, April 14	Holland	unknown 1
Week13	Wed, April 16	Holland	unknown 2
Week14	Mon, April 21	Holland	unknown 3
Week14	Wed, April 23	Holland	unknown 4
Week15	Mon, April 28	Holland	presentations
Week15	Wed, April 30	Holland	presentations
Week16	Mon, May 5	Holland	presentations

Statement for Students with Disabilities:

- If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact SDSU Student Ability Success Center at (619) 594-6473
- To avoid any delay in the receipt of your accommodations, you should contact SDSU Student Ability Success Center as soon as possible.
- Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have

presented your instructor with an accommodation letter from SDSU Student Ability Success Center. Your cooperation is appreciated.

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 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.

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.

Academic Dishonesty:

There is zero tolerance for academic dishonesty. Incidents of plagiarism and/or cheating will be reported and a zero grade assigned for all persons involved.

Land Acknowledgement:

For millennia, the Kumeyaay people have been a part of this land. This land has nourished, healed, protected and embraced them for many generations in a relationship of balance and harmony. As members of the San Diego State University community, we acknowledge this legacy. We promote this balance and harmony. We find inspiration from this land, the land of the Kumeyaay.

Diversity and Inclusion:

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.