

Course Syllabus

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CHEM 457 Instrumental Methods of Chemical Analysis

Spring 2021 (9 AM #20796 and 12:00 #20797)

Course Information

Class Days: Mon and Wed

Class Times: 9:00-11:40 AM or 15:00-17:40 PM

Class Location: CSL 222 or ONLINE as indicated in the schedule table

Zoom Meeting Room (applied to all sections): Meeting ID 975 8131 3168, Link

<https://SDSU.zoom.us/j/97581313168> (<https://sdsu.zoom.us/j/97581313168>)

Mode of Delivery: Hybrid

Instructors:

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Dr. Greg Elliott, CSL 229A, (619) 594-5264, gelliott@sdsu.edu (<mailto:gelliott@sdsu.edu>)

Dr. David Onofrei, NMR Lab, chem-nmr@sdsu.edu (<mailto:chem-nmr@sdsu.edu>)

Prerequisites:

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

Student Learning Objectives:

In this laboratory course, students will study instrumental methods of chemical separations and 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 electrochemistry, fluorescence microscopy, gas chromatography, liquid chromatography, mass spectrometry, nuclear

magnetic resonance, and optical spectroscopic methods,

5. Use a combination of instrumental methods to determine chemical structures of organic compounds, and
6. Prepare presentations describing experimental results obtained in the lab.

Textbooks (same as those for Chem 550):

Required: Principles of Instrumental Analysis, Skoog, Holler and Crouch, 7th Ed., Thomson, 2018.

Optional: Instrumental Analysis: Granger, Robert M., Yochum, Hank M., Granger, Jill N., Sienerth, Karl D., 1st Ed., Oxford, 2017.

Lab Manuals: Available in Canvas

Course Design: The course is consisting of three major components: 1) optical microscopy, 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.

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. In the table below you will find the point values for each course component.

Table 1. Grade scheme for CHEM 457 components with allotted marks in brackets

Component	Assignment & Homework	Lab reports	Quiz	Subtotal
Optical Microscopy	Excel (30), Image j (40), Particle Tracking Practices (50)	BF (70), DF (70), FM1 (100), FM2 (100)	Self-assessment quizzes, Pre-lab quizzes, Theory & Lab Quiz (130)	590
Chromatography		HPLC1 (50), HPLC2A (65), HPLC2B (65), GC1 (50), GC2A (65), GC2B (65)	HPLC (50), GC (50)	480
Molecular Spectroscopy	MS (50), NMR (50)	Oral Presentation (200)	IR (10), MS (50), NMR (50)	410
Participation				20
			Total	1500

All deadlines are firm and extensions will not be provided on an individual basis. In any late submission, a 10% per day late penalty will be applied with the max penalty of 50%. Assignments will receive a grade of zero after five days late. 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.

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):

*The schedule may be modified depending on the final enrollment.

*The course is provided in a hybrid mode. **All labs indicated as CSL222 are face-to-face. The rest will be virtual via Zoom.** See the zoom link above.

[See the lab schedule Table on the last page.](#)

Safety Policies and PPE requirements:

Prior to each lab entry, students must fill out a [COVID-19 Symptom Tracker Form](#)

(https://docs.google.com/forms/d/e/1FAIpQLScHV7zZcH_wSQIMfLmGUSAg8KiGW7VE8-8svQ5FCG4xF8nhqQ/viewform?usp=sf_link). Students must have their temperature taken by TA prior to entering the lab. All students are required to wear a face mask, lab coat, gloves, and safety glasses.

Students without appropriate PPE will not have access to the lab. A face mask must cover the mouth and nose at all times. Anyone who doesn't follow this policy will be asked to leave the lab immediately. When entering the lab student's temperatures will be checked and everyone will need to use hand sanitizer before entering the lab and leaving the lab (this should be provided in the lab). There will be a set pathway that all students will adhere (e.g. one entrance and one exit).

Mandatory COVID-19 Testing: All students will be required to regularly test for COVID-19 in spring 2021. See the information on COVID-19 testing offered by Student Health Services. If students are tested at Student Health Services, the results will be automatically updated to WebPortal. But for all testings done at the Alumni center, any other County sites, or third party health provider, students must upload their results to [HealthConnect \(https://healthconnect.sdsu.edu/\)](https://healthconnect.sdsu.edu/) for the instructors to see the results in WebPortal. Students who do not have results available in WebPortal cannot come to in-person labs and should contact instructors ASAP.

Required PPE:

Face mask: Wear actual masks (e.g. surgical, sewn cotton, N95, etc.). Knitted masks, Fleece neck gaiters, or bandanas are NOT allowed. See [this recent research article](#) for droplet transmission through different face masks.

Lab coat

Safety glasses

Closed-toed closed heeled shoes

Pants

T-shirt

Gloves (optional but encouraged)

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 / 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.

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.

CHEM 457 Schedule Spring 2021

SV = Synchronous Virtual, AV = Asynchronous Virtual, CSL222 = Face to Face Lab

Professor	Date	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Lee	Wed 20-Jan	Check In (SV)					
	Mon 25-Jan	Microscopy Lecture & Quantitative Image Analysis using ImageJ (SV)					
	Wed 27-Jan	Microscopy Lecture (SV) & Excel Basics Review (AV)					
	Mon 1-Feb	Data Analysis Practice: Single Particle Tracking and Nonlinear fitting in Excel using SOLVER (SV)					
	Wed 3-Feb	Fluorescence 2 (SV)					
	Mon 8-Feb	Data Analysis Fluorescence 2 (AV)					
	Wed 10-Feb	Fluorescence 1 (CSL222)	Fluorescence 1 (CSL222)	IR (CSL222)	IR (CSL222)	Dark Field 1 (CSL222)	Dark Field 1 (CSL222)
	Mon 15-Feb	Data Analysis Fluorescence 1 (AV)	Data Analysis Fluorescence 1 (AV)	Bright Field (CSL222)	Bright Field (CSL222)	Data Analysis Dark Field (AV)	Data Analysis Dark Field (AV)
	Wed 17-Feb	IR (CSL222)	IR (CSL222)	Dark Field 1 (CSL222)	Dark Field 1 (CSL222)	Fluorescence 1 (CSL222)	Fluorescence 1 (CSL222)
	Mon 22-Feb	Bright Field (CSL222)	Bright Field (CSL222)	Data Analysis Dark Field (AV)	Data Analysis Dark Field (AV)	Data Analysis Fluorescence 1 (AV)	Data Analysis Fluorescence 1 (AV)
	Wed 24-Feb	Dark Field 1 (CSL222)	Dark Field 1 (CSL222)	Fluorescence 1 (CSL222)	Fluorescence 1 (CSL222)	IR (CSL222)	IR (CSL222)
	Mon 1-Mar	Data Analysis Dark Field (AV)	Data Analysis Dark Field (AV)	Data Analysis Fluorescence 1 (AV)	Data Analysis Fluorescence 1 (AV)	Bright Field (CSL222)	Bright Field (CSL222)
	Wed 3-Mar	IR lecture (SV); Microscopy/IR Quiz on March 7					
Mon 8-Mar	No lab, Rest and recovery day						
Harrison/ Forsberg	Wed 10-Mar	Mass Spectrometry Lecture / MS Quiz (SV)					
	Mon 15-Mar	Mass Spectrometry Lecture / Assignment (SV)					
Onofrei	Wed 17-Mar	NMR Lecture / Practice (SV)					
	Mon 22-Mar	NMR Lecture / Assignment (SV)					
Harrison/ Forsberg	Wed 24-Mar	Buffer Class (SV / AV)					
	Mon 29-Mar	Chromatography Lecture					
	Wed 31-Mar	No lab, Holiday-Cesar Chavez Day					
	Mon 5-Apr	GC 1 (AV)	GC 1 (AV)	GC 1 (AV)	HPLC 1 (AV)	HPLC 1 (AV)	HPLC 1 (AV)
	Wed 7-Apr	GC 2A (CSL 222)	GC 2A (CSL 222)	GC 2A (CSL 222)	HPLC 2A (CSL 222)	HPLC 2A (CSL 222)	HPLC 2A (CSL 222)
	Mon 12-Apr	GC 2B (CSL 222)	GC 2B (CSL 222)	GC 2B (CSL 222)	HPLC 2B (CSL 222)	HPLC 2B (CSL 222)	HPLC 2B (CSL 222)
	Wed 14-Apr	HPLC 1 (AV)	HPLC 1 (AV)	HPLC 1 (AV)	GC 1 (AV)	GC 1 (AV)	GC 1 (AV)
	Mon 19-Apr	HPLC 2A (CSL 222)	HPLC 2A (CSL 222)	HPLC 2A (CSL 222)	GC 2A (CSL 222)	GC 2A (CSL 222)	GC 2A (CSL 222)
	Wed 21-Apr	HPLC 2B (CSL 222)	HPLC 2B (CSL 222)	HPLC 2B (CSL 222)	GC 2B (CSL 222)	GC 2B (CSL 222)	GC 2B (CSL 222)
	Mon 26-Apr	Buffer lab period / assignment work (SV, CSL 222 arranged with Dr. Forsberg)					
	Wed 28-Apr	Structure Characterization Presentations (SV)					
	Mon 3-May	Structure Characterization Presentations (SV)					
	Wed 5-May	Buffer Class for Structure Characterization Presentations (SV)					

HPLC = high pressure liquid chromatography, GC = gas chromatography, IR = infrared, NMR = nuclear magnetic resonance, MS = mass spectrometry