Course Syllabus

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Course Information
Class Days: Tue and Thu
Class Times: 9:00-11:40 AM or 12:00-2:40 PM
Class Location: CSL 222
Mode of Delivery: In-person
Instructors:

Dr. Greg Holland, GMCS-213C, **gholland@sdsu.edu (mailto:gholland@sdsu.edu)**

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

Dr. Youngkwang Lee, EIS 17, (619) 594-3167, Highly recommends using Canvas to email Dr. Lee, or your email may be buried in a long queue of emails. **youngkwang.lee@sdsu.edu. (mailto:youngkwang.lee@sdsu.edu) (mailto:youngkwang.lee@sdsu.edu) https://leelab.sdsu.edu. (mailto:youngkwang.lee@sdsu.edu)** (office hours: Need appointment via email.)

TAs: Julian Grim and Ellen Kuang. TAs can be reached via Canvas email.

Prerequisites:
Chemistry 251, 432, 432L and credit or concurrent registration in Chemistry 410B; concurrent registration in Chemistry 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, 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.
- 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	**1165**
Excel basics	10
Pipetting, weighing and concentration preparation	25
Spectrophotometric Determination of Copper	40
GC	125
HPLC	125
NMR	125

Other Methods	75
Oral/Written Presentations	200
Introductory Materials Hwk	25
NMR Hwk	25
MS Hwk	25
IR Hwk	25
NMR Quiz	25
IR Quiz	25
MS Quiz	25
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.