

College of Natural & Mathematical Sciences
CHEM 310 Applied Spectroscopy (3,3)
Prerequisites: CHEM 226 and CHEM261

Spring 2014
4 Credits
Instructors:

Dr. R. Marshall Werner (Primary)	327 CRW	(906)-635-2281	mwwerner@lssu.edu
Dr. Christopher Heth	319 CRW	(906)-635-2438	cheth@lssu.edu
Dr. Alexei Iretski	316 CRW	(906)-635-2045	airetski@lssu.edu
Dr. R. Adam Mosey	326 CRW	(906)-635-2284	rmosey@lssu.edu

Course Meeting Time

Lecture in 305 Crawford Hall; TR 12:30-1:50PM

Labs in 310/335/354 Crawford Hall; Thursday 2-5 pm (and additional time as needed)

Office Hours: (See office hours for specific instructors)

Monday	Tuesday	Wednesday	Thursday	Friday
tba	tba	tba	tba	tba

Recommended Texts: "Spectrometric Identification of Organic Compounds" (7th ed), R.M. Silverstein, et. al. 2005. Wiley. Also, Pavia, Lampman, Kriz, Vyvyan. Introduction to Spectroscopy. 4th edition, Brooks/Cole, 2009. Copies of Recommended texts will be available in Room 335/354.

Supplemental Items: calculator

Required Laboratory Items: Approved safety goggles or glasses; lab notebook with gridded duplicate pages, 3-ring binder

Blackboard: Handouts and assignments that will be used in this class may be available on blackboard.

Course Description: *General principles of spectroscopy will be explored including underlying principles and theory, data acquisition and processing coupled with spectral interpretation.. Different spectroscopic methods used for the structural determination of organic molecules and in chemical research are described including mass spectrometry (MS), ultraviolet and visible spectroscopy (UV-Vis), infra-red spectroscopy (IR), atomic spectroscopy, fluorescence spectroscopy, and both one-dimensional and two-dimensional ¹H and ¹³C nuclear magnetic resonance (NMR) spectroscopy. Prerequisite: CHEM226, CHEM261.*

Course Goals: The goal of this course is to expand the student's knowledge of spectroscopic techniques, theory and application for the structural identification of a variety of molecules.

Course Objectives: At the conclusion of CHEM 310, the student will be able to:

Learning Outcomes:

- The student will be able to collect various types of data using different spectroscopic techniques.
- The student will be able to process various types of data using different spectroscopic techniques.
- The student will be able to interpret various types of data using the different spectroscopic techniques described.
- The student will be able to integrate various spectroscopic techniques to determine molecular structure.
- The student will be able to explain how various spectroscopic techniques can be used in chemical research.

Grading Scale and Policies:

Point Values:

Quizzes (4 @ 50 pts ea)	200 points
Final Exam	100 points
Homework (4 @ 50 pts. each)	200 points
Final Identification Project	300 points
Lab Notebook (4 @ 50 pts. ea.)	200 points

Grading Scale:

92-100	A	71-74	C
88-91	A-	68-70	C-
85-87	B+	65-67	D+
81-84	B	61-64	D
78-80	B-	58-60	D-
75-77	C+	0-57	F

Total 1000 points *The instructors reserve the right to curve the grading scale as deemed necessary.

Quizzes: Four (4) scheduled quizzes will be administered during the semester and will be held during the laboratory period. Each exam/quiz will be worth 50 points. No make-up exams/quizzes will be administered in this class.

Final Exam: A cumulative final exam will be administered for the course on Tuesday, April 29, from 12:30-2:30 PM in 305 Crawford Hall. The final exam will be worth 100 points. Those missing the final exam without a valid well-documented and pre-approved excuse will not be allowed to take a make-up exam and will receive a score of zero for the final exam.

Homework Assignments/Problem Sets: Home work problem sets will be administered by each different instructor and will be graded by that instructor. These homework assignments will contain problems that will be similar to material that will be presented on exams/quizzes. There will be a total of 4 problem sets worth 50 pts. each (total 200 pts.); problem sets may be broken into two problem sets as determined by each professor.

Unknown Identification Project: During the first or second week of lab, you will be given a series of unknown compounds. The structure of these compounds will be determined and reported by students by the end of the semester. You will utilize the various techniques discussed during the course, in addition to your intellect and any other resources at your disposal to determine these structures.

Participation and Attendance: Attending class and lab, completing assignments on time, and keeping up with the class material is important for success in this course and in college. Students are responsible for obtaining all notes and assignments made in class. Note again that make-up quizzes will not be administered.

Grading Issues: Exams/Quizzes will be administered and graded by the various faculty teaching the particular portions of the course. Any re-grading requests must be made to the specific instructor administering that exam.

Exam/Quiz Schedule:

*The instructor/s reserves the right to modify this schedule with sufficient notice. TBA

Academic Dishonesty: Academic dishonesty of any kind will not be tolerated in this course, in alignment with the Lake Superior State University Student Honor Code. Students are expected to perform all assigned work themselves unless otherwise noted. Any form of cheating or plagiarism will be handled in accordance with the Honor Code Procedures. Violations of the Honor Code may result in an F for the course grade.

Electronic Devices/Disruptive Behavior: No electronic devices may be used during lectures, quizzes or exams including but not limited to laptops, cell phones, and portable media devices without prior permission from the instructor. Disruptive behavior during lecture including but not limited to electronic device usage, talking, or otherwise disturbing fellow students may result in the loss of 25 points for each incidence. Use of electronics or disruptive behavior during graded assignments (including quizzes and exams) may result in immediate dismissal from the lecture hall and a grade of zero (0) for the assignment.

Tentative Course Outline

*The instructor reserves the right to modify this schedule with sufficient notice.

Week	Date	Topic
1	1/13	Introduction to course and Professors, Dr. Iretski UV/Vis
2	1/20	Dr. Iretski UV/Vis, IR, Problems (Students Given Unknowns)
3	1/27	Dr. Iretski IR, Problems
4	2/3	Dr. Heth Molecular formulas, Elemental Analysis, Mass Spec., Problems
4-5	2/10	Dr. Heth Mass Spec.
5-6	2/17	Dr. Heth Mass Spec., Problems
6	2/24	Dr. Werner Theory of 1D ^1H and ^{13}C NMR, Problems
7	3/3	Spring Break Week
	3/10	Dr. Werner, Dr. Mosey Coupling in 1D ^1H and ^{13}C NMR, Problems
8	3/17	Dr. Werner, Dr. Mosey Spectra interpretations and 1D ^1H and ^{13}C NMR Structural Problems
9-10	3/24	Dr. Werner Non-traditional NMR nuclei
10-11	3/31	Dr. Mosey Advanced 1D Problems
11-12	4/7	Dr. Werner, Dr. Mosey Intro to 2D NMR, Theory
12-13	4/14	Dr. Werner, Dr. Mosey 2D ^1H - ^1H NMR, basic problems COSY, NOESY
13-14	4/21	Dr. Werner, Dr. Mosey 2D ^1H - ^{13}C NMR, advanced problems DEPT and HMQC
14	4/28	Final Exam Week (Unknown Assignments Due)

University Policies and Statements:

The Americans with Disabilities Act & Accommodations

In compliance with Lake Superior State University policies and equal access laws, disability-related accommodations or services are available to students with documented disabilities.

If you are a student with a disability and you think you may require accommodations you must register with Disability Services (DS), which is located in the KJS Library, Room 103, (906) 635-2355 or x2355 on campus. DS will provide you with a letter of confirmation of your verified disability and authorize recommended accommodations. This authorization must be presented to your instructor before any accommodations can be made.

Students who desire such services should meet with instructors in a timely manner, preferably during the first week of class, to discuss individual disability related needs. Any student who feels that an accommodation is needed – based on the impact of a disability – should meet with instructors privately to discuss specific needs.

IPASS (Individual Plan for Academic Student Success)

If at mid-term your grades reflect that you are at risk for failing some or all of your classes, you will be contacted by a representative of IPASS. The IPASS program is designed to help you gain control over your learning through pro-active communication and goal-setting, the development of intentional learning skills and study habits, and personal accountability. You may contact 635-2887 or email ipass@lssu.edu if you would like to sign up early in the semester or if you have any questions or concerns.

Honor Pledge

As a student of Lake Superior State University, you have pledged to support the Student Honor Code of the College of Engineering & Technology. You will refrain from any form of academic dishonesty or deception such as cheating, stealing, plagiarism or lying on take-home assignments, homework, computer programs, lab reports, quizzes, tests, or exams which are Honor Code violations. Furthermore, you understand and accept the potential consequences of punishable behavior.

CHEM 310 Laboratory Syllabus

Lab Meeting Times: Labs in 310/335/354 Crawford Hall; Thursday 2-5 pm

Required Laboratory Text: *handouts, postings on Blackboard, reference materials in lab.*

Required Laboratory Items: Approved safety goggles or glasses; lab notebook with gridded duplicate pages, 3-ring binder.

Tentative Laboratory Outline

Week	Date	Topic
1	1/16	All professors present, Dr. Iretski
2	1/23	Dr. Iretski, Unknown Compounds Distributed (DO NOT LOSE THESE)
3	1/30	Dr. Iretski
4	2/6	Dr. Heth
4-5	2/13	Dr. Heth
5-6	2/20	Dr. Heth
6	2/27	Dr. Werner
7	3/6	Spring Break – NO LAB
	3/13	Dr. Werner/Mosey
8	3/20	Dr. Mosey
9-10	3/27	Dr. Mosey
10-11	4/3	Dr. Mosey
11-12	4/10	Dr. Werner
12-13	4/17	Dr. Werner
13-14	4/24	All professors, final project week
14	4/28-30	Final Exam Week – Final Project Compound Identification due Wed. April 30 by 12 noon.

*The instructor reserves the right to modify this schedule with sufficient notice.

Lab Notebook: One crucial practice in spectroscopy is keeping a detailed lab notebook and spectra binder. The notebook should include enough information that another scientist in the field could read your notebook and understand what was done, determine the outcome of the labs, and repeat the experiments. Write in the notebook with a ball-point pen, crossing through errors. Do not remove original pages from the notebook.

Notebook Contents:

Compound and Type of Spectroscopy Performed – this section should list all the pertinent instrument settings used to collect data on the particular compound. You will need to devise a system of compound and spectra numbering and naming so that you can easily associate your collected spectra with various compounds that you have analyzed.

Procedure and Observations – This section will be completed during the lab and will include all steps as you have performed them and all masses as you have weighed them. This section will also include observations such as boiling ranges, melting points, color changes, etc.

Results – This section will be completed after the lab and will include percent yield, laboratory questions, etc.

Spectra Binder: You will need a 3-ring binder to collect all of your spectra in and keep them organized. The use of separating tabs with labels is a good way to keep spectra separate and allow easy access to your spectra. Your spectra will need to be appropriately identified to match with your notebook numbering scheme. The worst thing is to collect spectra that can't be identified. Use a numbering scheme to keep track of compounds.

Clean-up: At the end of the lab period, make sure that all instruments are in good working order and cleaned appropriately. Clean up all materials, solvent, etc. that were used during the course of the lab. **All equipment should be cleaned and returned to their designated location (i.e. IR Cells, NMR tubes, etc.).**

ATTENDANCE IS MANDATORY FOR ALL LABS. If you have a sanctioned university event that precludes you from attending normal lab time, you will need to schedule a time to make up the lab.

* The instructor retains the right to change this syllabus as he deem necessary at any time during the semester.