COLORADO MESA UNIVERSITY

Instrumental Analysis
CHEM 431 Section 001, 25345
Fall 2019

Instructor Contact Information

Instructor	**Sam Lohse, Assistant Professor (Chemistry)**
Physical	WS 230A
Email	slohse@coloradomesa.edu (Please feel free to email me with any questions. E-mail is the best way to reach me, and I generally respond to emails within a few hours, or a day at the outside.)
Office Phone	970-248-1590
Office Hours	**MTWF 12-12:50 PM, M 5:00-5:50 PM, T 1:00-2:30 PM.** If none of my regular office hours work for you, I am happy to schedule a meeting with you outside of these times, as much as my schedule allows. I will also answer simple homework questions by e-mail, whenever possible. As long as my office door is open, and I'm not too busy, please feel free to come by and ask questions.

Course Information

Class Meeting Times	MWF 11-11:50 AM, WS 366
Prerequisites	CHEM 301, CHEM 301L or instructor permission
Co-requisite	CHEM 431L
Drop Date	September 3th
Withdrawal date	October 14th
Final Exam	Wednesday, December 11th, 10:00 AM

Required Text and Supplies. There is no required text for this course. I would recommend that you purchase one of the following text books (old editions are fine). I will be drawing on several of these sources, as well as research articles for the lecture material.

- Skoog, Holler, and Crouch. *Principles of Instrumental Analysis*. Cengage Publishing (5th,6th, or 7th ed)
- Harris. *Quantitative Chemical Analysis* (7th, 8th, or 9th ed)
- Granger, Yochum, Granger, and Siernith. Instrumetal Analysis. Oxford University Press (1st ed)

Course Description

Instrumental Analysis is the second semester of Analytical Chemistry. The focus in this course moves from "traditional" methods of chemical analysis to modern instrumental methods for chemical analysis. We will cover a variety of instrumental analysis methods, including atomic spectroscopy, chromatography, electrochemical detection, X-ray spectroscopy, mass spectrometry, and advanced microscopy. We will also discuss the construction and basic operation of typical instruments.

An undergraduate student should expect to spend a minimum of two hours on this course outside the classroom for every hour in the classroom. The outside hours may vary depending on the number of credit hours or type of course; for an upper division chemistry class, most students will probably need to spend three hours outside of class for every hour spent in class. More details are available from the instructor, department office, or in CMU's *Curriculum Policies and Procedures Manual*.

Program Learning Outcomes

A student who completes the B.S. in Chemistry will be able to:

- Demonstrate fluency in the concepts from the major fields of chemistry (inorganic, organic, physical, and analytical...)
- Utilize mathematics to solve chemical problems.
- Employ proper experimental techniques.
- Interpret chemical information from peer-reviewed publications.
- Communicate chemical topics effectively, both verbally and in writing.

Student Learning Outcomes

The student learning outcomes for this course are:

- Describe the construction and operation of modern chemical instrumentation
- Interpret data from instrumental analyses to accurately identify or quantify chemicals
- Describe how to select an instrumental analysis technique (or suite of complementary techniques) to solve an analytical problem
- Read and interpret the professional chemical literature relating to analytical chemistry

General Course Information

I will post handouts, homework, exam solution keys, ppt lecture notes, course news, and all important course documents on D2L. I recommended that you check D2L frequently for new postings.

Assignments and Exams

Grade Determination:

Homework. You will have eight graded homework assignments in this class for a total of 100 points. HW assignments will be posted to D2L as handouts (and distributed in class) ~ 1 ½ weeks before they are due. The homework will consist of two parts. There will be a pre-lecture survey to complete and a series of ~10 homework problems. You should be able to complete the homework problems by applying the key ideas or concepts discussed in class to new problems you have not seen before. Your lowest homework score will be dropped. Homework assignments are graded largely on effort and level of completion. *Remember, it's about the problem solving process.*

Quizzes. Six quizzes will be given throughout the course of the term, always on Fridays. The quizzes will last about 20 min. Your lowest quiz score will be dropped.

Exams. One midterm exam will be given. The date of the midterm is given on the course calendar. The exam will include an in-class portion and one (or two) take-home problem(s), which will be given in class on the exam day and will be due the following Wednesday. The midterm exam will be worth 100 points (75 pts for the in class portion, 25 points for the take-home).

Attendance for exams is required. Because I understand that things come up, I'm always happy to work with you in advance to schedule a makeup exam. However, in order to make sure you can take a makeup exam, be sure to contact me at least a week before the exam. Excused absences for participation in university-sponsored events, serious illness, or family emergencies will all be considered sufficient reasons to schedule a makeup exam. Other requests for makeup exams will be considered on a case-by-case basis.

Student Projects. Just after mid-term, a student project will be due. The project will require a written report (~4 pages in length) and a short (~ 10 min) presentation in class. For this project, you will explain how you can use an instrumental technique to address a specific real-world problem. The midterm project will be worth 100 points. More details on the midterm project will be distributed during the second week of class.

Student Presentation. Students will be required to complete a ~ 25 min oral presentation and a short (~2 page written repot) at the end of the term. Students may work in groups of up to 3 for this assignment. The purpose of this project will be to have the group explain an instrumental analysis technique (one that we did not cover in class this term) to the class. More details on this assignment will be given around the midterm point. The oral presentation and report together will be worth 100 points.

Final. The final exam is a take-home exam, and will be distributed on the last Wednesday of regular class. The exam will be due by 12:00 pm on Wednesday Dec 13th. The final will be **comprehensive**. The final exam will be worth 100 points.

The Fall final exam schedule for CMU can be found here: http://www.coloradomesa.edu/registrar/important-dates/fall-finals.html

Student Assessment

Final course grades will be assigned based on the following component parts:

Grade Items	Point Value
Homework (Best 7 of 8)	100
Quizzes (Best 5 of 6)	100
Student Projects	100
Student Group Presentations	100
Midterm Exam	100
Final Exam	100
Total	**600**

Grading Scale:

At the end of the term, letter grades will be assigned according to the following percentage scale:

A ≥ 88%
B 87% - 78%
C 77% - 68%
D 67% - 59%
F <58%

Depending on the overall class performance, I reserve the right to alter this grading scale. However, I will only change the scale so that the average grade goes up, I will not change the scale in such a way that it will be to the detriment of any student.

Academic Dishonesty: Any instances of cheating or plagiarism by students in this class will be dealt with on a case by case basis in accordance with the guidelines outlined in the Colorado Mesa University student handbook (The Maverick Guide, p. 15-21).

http://www.coloradomesa.edu/studentservices/conduct.html

Important Dates:

- August 19, 2019- Classes begin
- August 26, 2019 Chemistry Laboratory Courses Begin
- September 3, 2019- Last Day to Add/Drop a Full-Semester Class
- **October 11th- Fall Break**
- October 14, 2019- Last Day to Withdraw from a Class
- **November 25-29th Thanksgiving Break**
- December 6- Last Day of Regular Classes
- December 9-12- Final Exam Week

Further details on CMU policies and services related to this course can be found on the full syllabus on the course D2L page. A course calendar with all exam and quiz dates can also be found on the D2L page. The GT Pathways statement can also be found with the syllabus on the D2L page. ***If you have any other concerns or questions about the course or course materials, or you find anything unclear, please don't hesitate to contact me.***

Tentative Lecture Schedule

Week #	Description
1	Intro, Advanced Statistics in Chemistry, Least Squares Regression
2	Statistics (cont'd), Basic Instrument Design
3	Circuits Review, Figures of Merit, Signal to Noise Ratio
4	Absorbance Spectroscopy
5 **(Sep 22)**	Atomic Spectroscopy **(Exam 1)**
6	Atomic Spectroscopy (Cont'd)
7	Electrochemistry
8	Chromatography: Gas Chromatography
9 **(Oct 20)**	Chromatography: HPLC **(Exam 2)**
10	Chromatography/ Mass Spectrometry
11	X-Ray Analysis: X-ray Diffraction
12	X-Ray Analysis: X-Ray Photoelectron Spectroscopy
13	Advanced NMR Analysis (2-D NMR)
14	**Thanksgiving Break**
15 **(Dec 1)**	Vibrational Spectroscopy: Raman Spectroscopy, Electron Microscopy **(Exam 3)**
16	Student Presentations
	FINAL EXAM, WED Dec 13th @ 10:00 AM, WS 366