Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: https://catalog.uvu.edu/

Semester: Spring
Year: 2025
Course Prefix: CHEM
Course and Section #: 4000-001
Course Title: Instrumental Analysis
Credits: 2

Course Description

This is a senior-level college course intended for Chemistry majors and others whose majors require a knowledge of the advanced principles of chemical measurement and instrumentation. Students will study modern instrumentation, analysis techniques and the theories behind them. Concurrent registration with the Instrumental Analysis Laboratory (CHEM 4005) is required.

Course Attributes

This course has the following attributes:

☐ General Education Requirements
☐ Global/Intercultural Graduation Requirements
☒ Writing Enriched Graduation Requirements
☒ Discipline Core Requirements in Program
☐ Elective Core Requirements in Program
☐ Open Elective

Other: *Click here to enter text.*

Instructor Information

Instructor Name: Dr. Sally Rocks

Student Learning Outcomes

Upon successful completion of this course at Utah Valley University you will be able to:

1	Identify the internal components of modern instrumentation in chemical science
2	Evaluate various atomic spectrometric methods, instrumentation, and their use in quantitative analysis.
3	Distinguish between various molecular spectroscopic methods, instrumentation, and their use in quantitative and qualitative analysis.
4	Evaluate various electroanalytical methods, instrumentation, and their use in quantitative analysis.

5	Distinguish between various analytical separation methods, instrumentation, and their use in quantitative and qualitative analysis.
6	Formulate concepts of validation of data and experimental design.
7	Compose Chemistry-appropriate texts for both academic and industrial audiences

Course Materials and Texts

Textbook: Skoog, D. A.; Holler, F. J.; Crouch, S. R. *Principles of Instrumental Analysis, 7th Ed.*; Cengage Learning, Boston MA, 2018.

Materials: Scientific calculator with log, ln, square root and scientific notation. Computer with word processing and spreadsheet software.

Course Requirements

Course Assignments, Assessments, and Grading Policy

Course Grading Policy (percent of total points available):

A	93-100
A-	90-93
B+	87-90
B	83-87
B-	80-83
C+	77-80
C	73-77
C-	70-73
D+	67-70
D	63-67
D-	60-63
E	less than 60

Course Assignments and Assessments:

Category	Weight (% of grade)
Homework	15
Exams	45
Special Topics Paper	20
Final Exam	20

Homework

Homework will be assigned each week and is due via Canvas. Assignments will be composed of problems out of your textbook or problem sets your instructor generates. The homework is designed to help you practice the concepts covered in class and prepare you for exams.

Exams
There will be three exams, each worth 15% of your grade. Content will be taken from lectures, homework sets and your textbook. Exams will be take home assignments and turned in via Canvas. The use of AI and tutoring services (such as Chegg) on exams is prohibited.

	Chapters Covered
Exam 1	Chapters 1, 5, 6-10
Exam 2	Chapters 11, 20, 13,-15
Exam 3	Chapters 26-28

Special Topic Paper
You will be writing a paper on an instrumental technique of your choice, which is worth 20% of your grade. The paper topic will be approved by your instructor prior to commencing the assignment, and must be different from a technique used in your student research. This paper will be pitched toward a commercial audience, which is a different method of writing than you may have experienced. The paper will be due the last day of class, although drafts of each section of the paper will be due earlier.

Final Exam
The exam is worth 20% of your total grade and will be cumulative.

Required or Recommended Reading Assignments
Skoog, D. A.; Holler, F. J.; Crouch, S. R. *Principles of Instrumental Analysis, 7th **Ed**.*; Cengage Learning, Boston MA, 2018.

Chapters 1, 5-11, 13-15, 20, 26-28

General Description of the Subject Matter of Each Lecture or Discussion

Category	**Topic**	**Relevant Book Chapter**
Introduction	Overview of Analytical Methods	1
	Signals and Noise	5
Atomic Spectroscopy	Light and Quantum Effects	6
	Instrument Components	7
	Optical Atomic Spectrometry	8
	Atomic Absorption	9
	Atomic Fluorescence	9
	Atomic Emission	10
Mass Spectrometry	Atomic Mass Spectrometry	11
	Molecular Mass Spectrometry	20
Molecular Spectroscopy	UV-vis Principles and Instrumentation	13
	Applications of UV-vis	14

	Applications of Luminescence Spectrometry	15
Chromatography	Intro. to Chromatography	26
	Gas Chromatography	27
	High-Performance Liquid Chromatography	28
Surface Techniques	Surface Characterization- XPS and AFM	21

Required Course Syllabus Statements

Generative AI

The *ethical* use of AI tools in this class is encouraged. AI programs are not a replacement for your human creativity, originality, and critical thinking. Writing, thinking, and researching are crafts that you must develop over time to develop your own individual voice. At the same time, you should learn how to use AI and in what instances AI can be helpful to you.

The use of generative AI tools (e.g. ChatGPT, CoPilot, etc.) is permitted in this course for the following activities:

- Brainstorming and refining your ideas;
- Fine tuning your research questions;
- Drafting an outline to organize your thoughts; and
- Checking grammar and style.

The use of generative AI tools is not permitted in this course for the following activities:

- Writing a draft of a writing assignment (unless this is the purpose of the assignment).
- Writing entire sentences, paragraphs or papers to complete class assignments.
- Generating responses to exam questions.

You are responsible for the information you submit based on an AI query (for instance, that it does not violate intellectual property laws, or contain misinformation or unethical content). Your use of AI tools must be properly documented and cited in order to stay within university policies on academic honesty. Any student work submitted using AI tools should clearly indicate what work is the student's work and what part is generated by the AI. In such cases, no more than 25% of the student work should be generated by AI. If any part of this is confusing or uncertain, please reach out to me for a conversation before submitting your work.

Using Remote Testing Software

☒ This course does not use remote testing software.

☐ This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or

immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

Required University Syllabus Statements

Accommodations/Students with Disabilities
Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU Accessibility Services at accessibilityservices@uvu.edu or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu

DHH is located on the Orem Campus in BA 112.

Academic Integrity
At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in UVU Policy 541: *Student Code of Conduct*.

Equity and Title IX
Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – TitleIX@uvu.edu – 800 W University Pkwy, Orem, 84058, Suite BA 203.

Religious Accommodation
UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.
To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at accessibilityservices@uvu.edu. If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a specially dedicated space for meditation, prayer, reflection, or other forms of religious expression.