

CHEM 3160. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Class time: Mon & Wed 11-11:50 AM, Aug 26-Dec 19, 2024.

Classroom: 1810 Gilman

Prerequisites: CHEM 2110, CHEM 2110L, Math 166, and *concurrent enrollment in 3160L*, Phys 2220 recommended.

Canvas: This course uses Canvas for all useful resources including this syllabus, lecture notes, announcements, manage grades, homework submission.

<https://canvas.iastate.edu/courses/110354>

Lecture Quiz: Through Top Hat (tophat.com). Course ID: 413106.

Office Hour: Fri 10-10:50am or make an appointment.

In-person or WebEx personal room (<https://iastate.webex.com/meet/yjlee>).

INSTRUCTOR: Young-Jin Lee, PhD, Professor, Department of Chemistry

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Course Objectives:

- *Understand operational principles of major instruments* used in analytical measurements.
- *Understand key figures of merits in each instrumentation* such as precision, resolution, sensitivity, and selectivity, *and how they are compared* between different instruments.
- *Be able to make informed decisions* which analytical methods are best suited for the study of a particular measurement.
- *Gain hands on experience* using some of the analytical methods discussed in this course in the accompanying laboratory course (CHEM 3160L).

TEXT: Principles of Instrument Analysis, 7th ed., 2017, Skoog, Holler, and Crouch

NOTE: This course is enrolled in the Iowa State University Immediate Access ONE program.

GRADING:

Three mid-term exams	100 pts x 3
Final Exam	200 pts
Lecture Quiz (Top Hat)	100 pts
Homework	100 pts

NOTE: Final grades are based solely on graded work and are NOT negotiable. The final grade distribution will be curved and consistent with prior years.

Exams:

Mid-term Exam Date: Sep 30, Nov 4, Dec 11

Final Exam: Dec 19, 7:30-9:30am (?)

Final exam is 2hr cumulative exam *with focus on overall course objective.*

Students who have *three or more finals on the same calendar day* may request to reschedule a final. The instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses. To reschedule, the student must notify the instructor prior to the last day of class before the beginning of dead week so the instructor has time to make appropriate arrangements.

The use of cell phones, media players, electronic translators, wireless communication devices, etc. is prohibited during exams. A Periodic Table, appropriate equations, and physical constants will be provided on the back sheet of each exam, if needed.

Scheduling conflict: There are *no make-up exams*. In the case of a scheduling conflict, students must contact the instructor to arrange accommodations *at least one week prior* to the exam. In the case of a *documented emergency* on the day of an exam, contact the instructor as soon as possible. An arrangement could be made in such cases *if approved*. A written document for such a valid reason (course schedule, travel for university events, medical emergency, etc.) is needed. A student who misses two exams will be asked to drop the course.

Lecture quiz:

It will be administered through Top Hat during the class. There will be quiz almost every day. Participants in the course evaluation at the end of the semester will receive extra five points in lieu of quiz point. Out of a total of ~110 lecture quiz points, only up to 100 point will be counted toward the final grading. *You may be allowed to do the make-up quiz if you are absent for legitimate reasons.*

Homework:

There will be **homework for almost every chapter**. The **problems and due dates** are one week after the class as indicated in the *Tentative Class Schedule* of this syllabus. Each HW set is 8 point. Out of total possible score of 112pt (14set x 8pt), only 100 pt will be included for the final grading purpose.

Homework should be submitted via Canvas, either typing in or uploading a file (e.g., handwritten paperwork, MS word) by 11:59pm on due date. There is late penalty of 10% each day for the next three days. Late homework is not accepted after three days unless approved by the instructor in advance. The TA will grade each student's homework for completeness and only selected problems for correctness.

Class Preparation and Conduct:

Reading the textbook is necessary to pass this course. Relevant chapters are indicated on the class schedule. *Exam will be only from the materials covered in class or in homework.*

To help promote a good learning environment for all, please be respectful in your behavior towards your fellow students and your instructor. Please refrain from any disruptive activities in the class, which might affect other students. **Your classmates are allowed and encouraged to ask you to discontinue distracting behavior. Students disturbing class will be asked to leave the room.** Turn off all electronic notifications during lecture.

It is to your benefit to participate in classroom discussions and ask questions!

Syllabus Statement

Free Expression

Iowa State University supports and upholds the First Amendment protection of **freedom of speech** and the principle of **academic freedom** in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

No employee, student, applicant, or campus visitor is compelled to disclose their pronouns. Anyone may voluntarily disclose their own pronouns.

Academic Dishonesty

The class will follow Iowa State University's policy on academic misconduct ([5.1 in the Student Code of Conduct](#)). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams and for following directions given by faculty, instructors, and ISU Test Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the [Office of Student Conduct in the Dean of Students Office](#). Information about academic integrity and the value of completing academic work honestly can be found in the [Iowa State University Academic Integrity Tutorial](#).

Accessibility Statement

Iowa State University is committed to advancing equity, access, and inclusion for students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of students with disabilities. Information about SAS is available online at www.sas.dso.iastate.edu, by email at accessibility@iastate.edu, or by phone at 515-294-7220.

Discrimination and Harassment

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu

Mental Health and Well-Being Resources

At Iowa State, we're committed to your success and well-being. As a Cyclone, you can access 24/7 resources, services, and people dedicated to helping you achieve your goals and be your best in and out of the classroom. Whether you need academic support or just someone to talk to, we're here for you at Cyclone Support (cyclonesupport.iastate.edu). If you are struggling emotionally and need support, there's confidential help available 24/7/365. You can call or text 988 or use the chat at 988lifeline.org.

Religious Accommodations

Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the [Dean of Students Office](#) at 515-294-1020 or the [Office of Equal Opportunity](#) at 515-294-7612.

TENTATIVE CLASS SCHEDULE

	Date	Reading	Homework in Questions and Problems	HW due
M	Aug 26	Ch 1. Introduction, Appendix 1	Ch 1: 1, 2, 9, Appendix a1: 4, 6, 7	Sep 4
W	Aug 28	Ch 5. Signal & Noise		
M	Sep 2	Labor Day		
W	Sep 4	Ch 5. Signal & Noise	Ch 5: 1, 2, 3, 5, 7, 10	Sep 11
M	Sep 9	Ch 6. Intro to Spectroscopy	Ch 6: 6-1(c, f-p), 3, 5, 9, 19	Sep 18
W	Sep 11			
M	Sep 16	Ch 7A-D. Optical Component	Ch 7: 2, 6, 7, 12, 20	Sep 25
W	Sep 18			
M	Sep 23	Ch 8A-B. Intro to Atomic Spectroscopy	Ch 8: 1, 5, 6, 9	Sep 30
W	Sep 25	Ch 9A-D. Atomic Absorption		
M	Sep 30	Exam 1		
W	Oct 2	Ch 10A. Atomic Emission Spectroscopy	Ch 9: 1 (a, c, f, i, j), 2, 3, 9, Ch 10: 2, 3, 8, 9	Oct 9
M	Oct 7	Ch 13. Intro to UV/Vis (except 13C, 13D-3)	Ch 13: 5, 7, 13(e), Ch 14: 5, 9	Oct 16
W	Oct 9	Ch 14A-D. Application of UV/Vis		
M	Oct 14	Ch 15A-C. Luminescence	Ch 15: 1, 2 (a-i, l, m), 3, 4, 5, 6	Oct 21
W	Oct 16	Ch 16. Infrared spectroscopy (7I, except 16B-2, 16B-3)	Ch 16: 1, 7, 8, 9, 10	Oct 23
M	Oct 21	Ch 17A-B. Application of IR	none	
W	Oct 23	Ch 18. Raman Spectroscopy	Ch 18: 1, 2, 3, 4(a), 5, 7	Oct 30
M	Oct 28	Ch 19A-E. Nuclear Magnetic Resonance	Ch 19: 2, 3, 4, 5(b, c, e, f), 6, 9, 10	Nov 6
W	Oct 30			
M	Nov 4	Exam 2		
W	Nov 6	Ch 11A-C, Ch 20A-C: Mass Spectrometry	Ch 11: 3, 4, 9, Ch 20: 11, 12, 18	Nov 18
M	Nov 11			
W	Nov 13	Ch 26. Intro to Chromatograph	Ch. 26: 1 (b-f, j, l), 2, 7, 10, 13, 14, 15	Nov 20
M	Nov 18			
W	Nov 20	Ch 27A-C. Gas Chromatography		
Thanksgiving				
M	Dec 2	Ch 28A-H. Liquid Chromatography	Ch. 27: 3, 9, 16, Ch 28: 10, 11, 22	Dec 9
W	Dec 4	Ch 23 & 25. Electrochemistry	none	
M	Dec 9			
W	Dec 11	Exam 3		
R	Dec 19	Final Exam (7:30-9:30am)		

* Final exam schedule is determined by the Registrar's office.