

CHEM 5770 Mass Spectrometry

Spring 2025 TTh 9:30-10:45 1813 Gilman

Instructor: Young-Jin Lee

Email: yjlee@iastate.edu

Office: 3759 Gilman

Phone: 294-1235

Office Hour: Right after class or make appointment.

Learning Outcome: Understand the fundamentals and instrumental aspects of mass spectrometry as well as mass spectral interpretation and various biological applications.

Pre-requirement: None. Basic knowledge in chemistry and physics is strongly recommended.

Grading

- 1st & 2nd Exam – 30% each.
- Homework– 10%
- Class quiz- 10%
- Final term report– 20%

Homework: Due in 1 week on Canvas after the corresponding lecture.

Final term report: There is no final exam but final term report is due in the Final week. There are three topics students can choose from for the final report: 1) new mass spectrometry instrumentation, 2) new mass spectrometry application, or 3) most recent novel publications in either instrumentation or application. Details will be discussed in the class.

Lecture Quiz: Through Top Hat (tophat.com). Course ID: 594265.

Textbook: The course is not following any formal textbook, but students may download the following free e-books from the library as reading materials.

FREE ON-LINE VERSION IS AVAILBLE THROUGH UNIVERSITY LIBRARY:

Optional Textbook 1: Mass Spectrometry: An Applied Approach, 2nd Ed, Ed. by Smoluch, Grasso, Suder, Silberring, Publisher: John Wiley & Sons, published in Jun 24, 2019
<https://onlinelibrary.wiley.com/doi/book/10.1002/9781119377368>

Optional Textbook 2: Mass Spectrometry, 2nd ed. By Jürgen H. Gross
Publisher: Springer, Published on Apr 6, 2011.
<https://link.springer.com/book/10.1007%2F978-3-642-10711-5>

Academic Dishonesty.

The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the [Dean of Students Office](#).

Accessibility Statement.

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations

for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

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

Religious Accommodation

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.

Contact Information for Academic Issues

If you are experiencing, or have experienced, a problem with any of the above statements, email academicissues@iastate.edu

Freedom of Speech

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.

Course contents and schedule (tentative)

Week	Date	Content	Homework
Basics			
1	Jan 21	0. Overview	HW 1
	Jan 23	1. History of MS	
2	Jan 28	2. Vacuum systems	HW 2
Ionization			
	Jan 30	3. Electron Ionization (EI)	
	Jan 30	4. Chemical Ionization (CI)	HW 3
3	Feb 4/6	5. Electrospray Ionization (ESI)	HW 4
4	Feb 11	6. Atmospheric pressure chemical ionization and photoionization (APCI/APPI)	
	Feb 11	7. Ambient Ionization	
	Feb 13	8. Matrix-Assisted Laser Desorption/Ionization (MALDI)	
5	Feb 18	9. Secondary ion mass spectrometry (SIMS)	HW 5
	Feb 20	10. Inductively coupled plasma (ICP)-MS	
6	Feb 25/27	11. Ion fragmentations in EI-MS	HW 6
7	Mar 4	12. EI spectral interpretation	HW 7
8	Mar 11	1st Exam	
Mass Analyzer			
	Mar 6	13. Magnetic sector	
Spring break (Mar 17-21)			
9	Mar 13/25	14. Quadrupole, Triple Quadrupole, Quadrupole Trap	HW 8
	Mar 27	15. Time-of-Flight (TOF)	
10	Apr 1	16. Fourier-transform MS (ICR, Orbitrap)	
	Apr 3	17. MS detector	HW 9
MS/MS			
11	Apr 8	18. Collision-Induced Dissociation	
	Apr 8	19. Photodissociation	
	Apr 10	20. Electron capture or transfer dissociation	HW 10
Miscellaneous			
12	Apr 15	21. Connection with Chromatography	
	Apr 17	22. Ion mobility mass spectrometry	
13	Apr 22	23. High-Resolution Mass Spectrometry	
	Apr 24	24. Mass spectrometry and isotope	
14	Apr 29	2nd Exam	
	May 1	25. MS for structural biology	
	May 1	26. ID of unknowns	
15	May 6	27. Applications to Metabolomics	
	May 8	28. Application to Proteomics	
Final report due May 15			