

EHT 622 – Mass Spectrometry Spring 2009

Location and Meeting Time: Monday and Wednesday, 2:30 – 3:50 PM
C530 Biggs Laboratory, Wadsworth Center, Empire State Plaza

Course Director: David Spink, Ph.D.
Office: E410 Wadsworth Center
Phone: 486-2532
Fax: 486-1505
Email: spink@wadsworth.org
Office Hours: 2:00-3:30 PM Tuesday and Thursdays or by appointment

Course Description: EHT 622 is a comprehensive course covering the principles, techniques, and applications of mass spectrometry. The course covers modern techniques of ionization, mass analysis, and ion detection, with emphasis on interpretation of spectra and application of mass spectrometry to environmental and biomedical problems and current research topics.

Prerequisites: EHT 520 – Principles of Environmental Chemistry or EHT 530 – Principles of Toxicology. Students who have an appropriate undergraduate background in organic chemistry and physics may also be admitted by consent of the course director.

Course Grading: Course grading is A through E. There are three exams, each accounting for 30% of the final grade. The third (final) exam covers the entire course. Students will make an in-class presentation of a current research paper and lead the discussion of the paper. This presentation will be worth 10% of the course grade.

Course Requirements:

Attendance: Attendance and class participation are required.

Text and Reading: There will be no assigned textbook for the course. Assigned readings will include handouts given in class and assigned papers from the current scientific literature (*Journal of the American Society for Mass Spectrometry*, *Journal of Mass Spectrometry*, *Analytical Chemistry*, etc.) For additional (unassigned) readings, the following books will be on reserve in the Dickerman Library.

E. de Hoffman and V. Stroobant, Mass Spectrometry: Principles and Applications John Wiley and Sons, Inc. New York, 2007.

C.G. Herbert and R.A. A. Johnstone, Mass Spectrometry Basics CRC Press, New York, 2003.

R.M. Smith and K.L. Busch, Understanding Mass Spectra – A Basic Approach John Wiley and Sons, Inc. New York, 1999.

A.G. Harrison, Chemical Ionization Mass Spectrometry CRC Press, New York, 1983.

F. W. McLafferty and F. Turecek, Interpretation of Mass Spectra Fourth Edition University Science Books, 1993.

HEHT 622 - Mass Spectrometry

Spring 2009

2:30 to 3:40 pm Monday, 2:30 to 4:00 pm Wednesday, Room C-530 Wadsworth Center

Syllabus

(final)

Date	Topic	Lecturer	
Jan	21 Wed	Introduction to Mass Spectrometry – history and basics	Spink
	26 Mon	Introduction to MS - resolution and stable isotopes	Spink
	28 Wed	Introduction to MS - magnetic sector instruments	Spink
Feb	2 Mon	Ion cyclotron and time-of-flight instruments	Spink
	4 Wed	Quadrupoles and tandem MS	Spink
	9 Mon	Ion traps	Spink
	11 Wed	Electron ionization MS - spectral interpretation	Spink
Feb 16 and 18 – Winter Break - no class			
	23 Mon	Exam I (covers material 1/21 through 2/11/09)	
	25 Wed	Chemical Ionization Mass Spectrometry	Briggs
Mar	2 Mon	Chemical Ionization Mass Spectrometry	Briggs
	4 Wed	Gas Chromatography/Mass Spectrometry	Aldous
	9 Mon	Inductively coupled plasma MS of trace metals	Aldous
	11 Wed	MS Applications in Environmental Science	Kannan
	16 Mon	Introduction to Liquid Chromatography/MS	Kannan
	18 Wed	MS Applications in Environmental Science	Kannan
	23 Mon	Exam II (covers material 2/25 through 3/18/09)	
	25 Wed	Mass Spectrometry of Biological Macromolecules	Hauer
	30 Mon	Mass Spectrometry of Biological Macromolecules	Hauer
Apr	1 Wed	Mass Spectrometry of Biological Macromolecules	Hauer
	6 Mon	Biomarker Analysis by Mass Spectrometry	Turesky

Apr 8 and 13 – Spring Break - no class

	15 Mon	Biomarker Analysis by Mass Spectrometry	Turesky
	20 Wed	Mass Spectrometry in newborn screening	Morrissey
	22 Mon	Orbitrap MS – principles and applications	Spink
	27 Mon	Current Topics in Mass Spectrometry - Student presentations	
	29 Wed	Current Topics in Mass Spectrometry - Student presentations	
May	4 Mon	Current Topics in Mass Spectrometry - Student presentations	

Final Exam – to be scheduled during exam week - Covers entire course

HEHT 622 Mass Spectrometry - Learning Objectives

The overall objective of the course is for the students to acquire an understanding of the principals and applications of mass spectrometry in environmental and biomedical research. Students will become familiar with different types of instrumentation, various methods for ionization and mass analysis, techniques for interfacing chromatographic separation techniques with mass spectrometry, and methods for quantitative analysis. The knowledge gained will allow the students to understand critically evaluate mass spectrometric data reported in the scientific literature and to use mass spectrometry in their own research and professional careers.

Specific Objectives of the Course are to:

- Familiarize the student with the commonly used methods of ionization, including electron, chemical, desorption, electrospray, and atmospheric pressure chemical ionization.
- Discuss the techniques and instrumentation for mass analysis, including electric and magnetic sectors, quadrupole mass filters, ion traps, ion cyclotrons, and time of flight instruments.
- Provide the students with an understanding of how structural determinations of small organic molecules as well as large biomolecules are made by using mass spectrometry through analysis of ion fragmentation patterns.
- Discuss in detail the combined techniques of gas chromatography-mass spectrometry and liquid chromatography-mass spectrometry.
- Present the development of quantitative mass spectrometry by use of stable isotope dilution techniques.
- Familiarize the students with the use of tandem mass spectrometry in structural elucidation and quantitative analysis.