

Biomedical Applications of Mass Spectrometry  
Syllabus for Chem 395-03/455-01  
Fall Semester 2016

Instructor: Dr. M. Paul Chiarelli, office FH 102 (email: mchiare@luc.edu, phone 508-3106) Office Hours Tuesday/Wednesday/Thursday 9:30-11:30 AM and **or by appointment.**

Book: "Introduction to Mass Spectrometry" by J. Throck Watson and O. David Sparkman, 4<sup>th</sup> edition, John Wiley and Sons, LTD, ISBN 978-0-470-51634-8.

Objectives: The specific objectives of this course are to acquaint the student with basic aspects of mass spectrometry. The focus of the course will be twofold. One is to acquaint the students with fundamental aspects of mass spectrometry. This section is primarily concerned with data interpretation and basic aspects of state-of-the-art instrumentation. The second focus will be on how these techniques are used in the diagnosis and treatment of different diseases, such as cancer, alzheimers, and Jacob Krutzfield (mad cow) disease to give a few examples. Students will be assigned reading in the appropriate sections of the textbook prior to lectures and exams. Other course material will be supplied by the instructor (journal articles, etc.) at the appropriate times.

Class Procedures: The class will meet on Mondays and Wednesdays from 4:15 to 5:30 PM in Flanner Hall 105. This is a 3 hr. credit course. There will be two exams and a final. There will be two problem sets that will be collected and graded. The problem sets will be concerned with mass spectra interpretation primarily. You will be asked to write one 5 to 10 page paper on a particular application of mass spectrometry on **a topic agreed upon by you and the instructor.** The contribution of each exam/assignment to your final grade breaks down as follows:

<u>Item</u>	<u>% grade</u>	<u>% total</u>
Problem Sets (2)	12.5%	25%
In-class exams	20%	40%
Paper	15%	15%
Final exam	20%	20%
<b>Total</b>		<b>100%</b>

A tentative list of meeting dates and the lecture titles are given below. **If there is a topic of particular interest you would like me to cover and don't see it below, come and talk to me. I will try to work it in.**

Monday	Aug 29	Discussion of Course Goals; Introductory Lecture "What is Mass Spectrometry?"
Wednesday	Aug 31	Appearance of a Mass Spectrum
Monday	Sept 5	Labor day, no class
Wednesday	Sept 7	Gas Chromatography/Mass Spectrometry GC/MS and Quadrupole Mass Analyzers
Monday	Sept 12	Electron Impact Ion Generation and Mechanisms of Ion Generation; Molecule Ions.
Wednesday	Sept 14	Elemental Compositions of Ions
Monday	Sept 19	Fragmentation reactions indicative of Molecular structure
Wednesday	Sept 21	Fragmentation reactions indicative of Molecular structure; continued
Monday	Sept 26	Analysis of disease biomarkers in body fluids (urine, serum, blood, etc.) by GC/MS.
Wednesday	Sept 28	Biomarker analysis by GC/MS continued.
Monday	Oct 3	Drug-testing and quantification by GC/MS
Wednesday	Oct 5	<b>Exam I</b>
Monday	Oct 10	Mid-Semester Break
Wednesday	Oct 12	Overview of Protein analysis strategies for disease diagnosis in Medicine.
Monday	Oct 17	Electrospray ionization and LC/MS analyses of proteins
Wednesday	Oct 19	Protein sequence and structure
Monday	Oct 24	Determining protein sequences by mass spectrometry

Wednesday	Oct 26	Tandem mass spectrometry of peptides
Monday	Oct 31	Tandem mass spectrometry of peptides
Wednesday	Nov 2	Electron capture and electron transfer dissociation methods for analyzing peptide sequences
Monday	Nov 7	Top-down product ion analyses of proteins
Wednesday	Nov 9	<b>Exam II</b>
Monday	Nov 14	Hydrogen-Deutrium exchange methods for tertiary protein structure determination
Wednesday	Nov 16	Tissue Imaging for Cancer diagnosis; Time-of-Flight (TOF) Mass spectrometry
Monday	Nov 21	Tissue imaging; TOF-SIMS and DESI
Wednesday	Nov 23	No class, Thanksgiving holiday
Monday	Nov 28	Applications to the study of heart disease
Wednesday	Nov 30	Analysis of Biologic Drugs
Monday	Dec 5	Mass spectrometry approaches to Metabonomics in the diagnosis of Kidney Disease
Wednesday	Dec 7	Orbitrap-based instrumentation and applications to disease diagnosis
Monday	Dec 12	<b>Final Exam</b>