CHEM 2540  3 credits.
“Mass Spectrometry”
SPRING 2017

INSTRUCTOR:  Dr. Renã A. S. Robinson
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LECTURES:    Mon/Wed 2-3:15 pm – Eberly Hall 228
OFFICE HOURS: TBD

PREREQUISITES:  Analytical Chemistry (0250) and Instrumental Analysis (1250)

TEXTBOOKS:  Listed below are the required/recommended textbooks for this course. Each is placed on reserve in the Chemistry Library. Visit Courseweb (http://courseweb.pitt.edu) for chapter excerpts, supplemental articles, reviews, lecture notes, problem sets, and grades.


COURSE DESCRIPTION:  Mass spectrometry (MS) is a widely-used analytical technique that provides useful qualitative and quantitative information across several disciplines. This course covers fundamental processes governing ionization, mass-to-charge separation, and detection of organic, biological, and a variety of other molecules and the interpretation of mass spectra from these molecules. A survey of ionization techniques, mass analyzers, detectors, and data analysis platforms will be covered and will be put into context of current and real-life applications of MS.

COURSE OBJECTIVES:  The goals of this course are to: 1) familiarize graduate students with the fundamental and practical aspects of mass spectrometry, 2) give students an opportunity to become better verbal communicators of chemistry-related concepts, and 3) equip students with the skills necessary to interpret various types of mass spectra.

LEARNING OUTCOMES:  Students will become comfortable giving scientific presentations on MS fundamentals, instrumentation, and applications through several individual and group oral assignments. At the end of the course, students will be
equipped with enough skills to interpret several types of MS data and to understand the utility and application of a variety of MS instruments.

**COURSE TOPICS:**
- Course Into & History
- Fundamental of MS-Isotopes
- Ionization sources (GD, ICP, EI, CI, APCI, MALDI, ESI, DESI, LSI, DART, …)
- MS analyzers – Figures of Merit, TOF MS, magnetic & electrostatic sectors, quadrupoles, ion traps, FTICR, Orbitrap,
- Detectors/Data acquisition processes
- Hybrid instruments
- Ion dissociation techniques (CAD, CID, HCD, ECD, ETD, UV-photodissociation); MS/MS and MS$^n$
- Coupling MS techniques (GC, LC, CE, IMS)
- Vacuum Systems
- MS spectral interpretation
- Database searching algorithms, libraries, and informatics
- Applications – proteomics, DNA/RNA analysis, imaging MS, polymer analysis, environmental applications, lipids/metabolomics, metal complexes and other inorganic species, reaction kinetics, folding/unfolding dynamics, use of MS in industry

** Every effort will be made to keep to the lecture schedule but note that the schedule is tentative. However, exam dates will be given as shown in the schedule.**

**COURSE EVALUATION:** Grades will be based upon scores from in-class participation, three in-class exams, a series of oral presentations, written proposal, and problem sets. Final letter grades will typically be assigned as follows, however I reserve the right to adjust the scales for letter grades depending on the overall performance of the class:

A $\geq$ 90%, B 80-89.9%, C 70-79.9%

There will be no make-up exams for missed exams unless arranged in advance for appropriate reasons.

**ASSIGNMENTS:**

*Reading assignments are expected to have been read prior to class.*

**In-class participation is expected, encouraged, and is mandatory.**

**Problem Sets:** Students will be placed into small groups and will work together to complete the problem sets. One member of the group will be responsible for submitting the assignment, however all group members should sign their names on the assignment. It is your responsibility to master the skills necessary to successfully complete each of the
problems. Group members are encouraged to come to office hours if additional guidance is needed. A single grade will be provided to all group members with exceptions based on peer evaluations. Finally, each group should be prepared to discuss solutions to problems during lecture.

**Oral presentations:** Each student will participate in a series of individual and group presentation (ranging in length) assignments. These assignments cover recent developments of MS ionization sources, analyzers, or applications of MS. Details regarding small oral assignments will be discussed in lecture. The final presentation assignment requires that students give an individual presentation (15-20 minutes) that either a) covers a proposed MS source, analyzer, instrument, or novel application or b) describes an independent MS research project (only graduate students). More information regarding assignments will be discussed during lecture.

**MS Practicum & Proposal assignment:** Graduate students only are required to submit a written paper that discusses the proposed idea or independent MS assignment for the final oral presentation assignment. The format for this paper is in the style of a *Rapid Communications in Mass Spectrometry* communication type article.

**ACADEMIC INTEGRITY:** Students in this course will be expected to comply with the University of Pittsburgh’s Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, noted below from the February 1974, Senate Committee on Tenure and Academic Freedom reported to the Senate Council, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz or exam will be imposed.

The integrity of the academic process requires fair and impartial evaluation on the part of faculty, and honest academic conduct on the part of students. To this end, students are expected to conduct themselves at a high level of responsibility in the fulfillment of the course of their study. It is the corresponding responsibility of faculty to make clear to students those standards by which students will be evaluated, and the resources permissible for use by students during the course of their study and evaluation. The educational process is perceived as a joint faculty-student enterprise which will perform involve professional judgment by faculty and may involve —without penalty—reasoned exception by students to the data or views offered by faculty.

**DISABILITIES:** If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Disability Resources and Services 216 William Pitt Union, (412) 648-7890/(412) 383-7355 (TTY),
as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.