Instructor: Dr. Chris Palmer, Chem Bldg 116B/203A, christopher.palmer@umontana.edu


We will also use information from published papers, and will give you the citations and post the manuscripts when we do.

Learning Outcomes: Mass spectrometry is a powerful analytical tool with applications across the various disciplines of chemistry. This course is designed to provide the student with a fundamental understanding of the principles of mass spectrometry and the instrumentation used in mass spectrometry, as well as to give the student an introduction into various applications of mass spectrometry in chemical and biochemical analysis. Learning Goals: 1) establish an understanding and appreciation of the physics of ion motion and how mass spectrometry utilizes these, 2) develop a working knowledge of the design and operation of various mass spectrometric instrumentation, 3) develop a familiarity with common applications of mass spectrometry, and 4) gain practical experience using commercial mass spectrometers, 5) develop familiarity with current research in mass spectrometry. Having completed this course, the student should be able to read the literature describing mass spectrometry developments and applications, and should be better prepared to utilize mass spectrometry in chemical biochemical research.

Background: It is assumed that students have an undergraduate level knowledge of physics and analytical chemistry as well as a familiarity with chemical names, structures and notations, chemical reactions and stoichiometry, and chemical reactivity. Students are also expected to have a basic working knowledge and understanding of spectroscopy.

Course Organization: Approximately the first half of the semester will be dedicated to the understanding of the design and operation of various mass spectrometers. During this period, the physics of ion motion will be covered, along with examples of how these fundamentals are utilized to separate ions in mass spectrometers. The specifics of various instrument designs, including production, separation and detection of ions, will be presented. At the end of this period there will be a written exam. The second half of the semester will be dedicated to applications of mass spectrometry in chemical and biochemical research. Some laboratory exercises will be completed to utilize commercial instrumentation. This section will also be followed by a written exam. Students will write a ~ ten page paper on a topic of current interest in mass spectrometry development or application. This could take the form of a critical review of a current paper from the literature considering related published works. Or, it could take the form of a literature review of a topic of interest.
Grading: Grades will be on the +/- scale (A,A-,B+, etc) with the following breakdown:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Instrumentation Exam</td>
<td>25%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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<tr>
<td>Research Paper</td>
<td>20%</td>
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<tr>
<td>Homework Questions and Problems</td>
<td>5%</td>
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<tr>
<td>Laboratory Exercises</td>
<td>20%</td>
</tr>
<tr>
<td>Preparation and Participation in Discussions</td>
<td>5%</td>
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Academic misconduct is subject to an academic penalty by the course instructor and/or disciplinary sanction by the University. Academic misconduct is defined as all forms of academic dishonesty. All of the academic policies found in the Student Conduct Code ([http://life.umt.edu/vpsa/student_conduct.php](http://life.umt.edu/vpsa/student_conduct.php)) apply to this course.

Of particular relevance to this course, it is considered academic misconduct to represent another person's words, ideas, data, or materials as one's own. It is also considered academic misconduct to copy from another student's paper, consult unauthorized material, give information to another student or collaborate with one or more students during an examination or academic exercise without the instructor's permission.

Students with Disabilities

If you are a student with a disability and wish to discuss reasonable modifications for this course, contact me privately to discuss the specific modifications you wish to request. Please be advised I may request that you provide a letter from Disability Services for Students verifying your right to reasonable modifications. If you have not yet contacted Disability Services, located in Lommasson Center 154, please do so in order to verify your disability and to coordinate your reasonable modifications. For more information, visit the Disability Services website at [http://www.umt.edu/disability](http://www.umt.edu/disability).

Important Dates

Important dates and deadlines regarding registration for the fall semester can be found at [http://www.umt.edu/registrar/calendar.php](http://www.umt.edu/registrar/calendar.php)
Lecture Schedule:

Jan. 11-18: History and Fundamentals of Mass Spectrometry (Chapter 1)

Part I: Instrumentation
Jan. 23-28: Ionization approaches (Chapter 2)
Jan. 30 - Feb. 8: Mass Analyzers (Chapter 3)
Feb. 11-13: Ion Detection (Chapter 3)
Feb. 15 – 20: Tandem Mass Spectrometry (Chapter 4)
Feb. 22 - 27 Hyphenated Techniques (Chapter 5)

Exam 1, March 1

Part II: Applications
Mar. 4-8: Lower molecular weight organics analysis (Chapter 6)
Mar. 11-13: Inorganics (Chapter 7)
Mar. 15-Apr. 26: Biochemical analysis, proteomics (Chapters 8 and 9), Lab exercises

Exam 2: Finals Week