I. Logistics

Instructor          Professor Betsy Stone  
Chemistry Building W313  
(319) 384-1863  
betsy-stone@uiowa.edu

Class Location/Time  Chemistry Building E264 CB  
Mondays and Wednesdays 3:30 – 4:45 PM

Office Hours  Mondays 1:30 – 2:30 PM, Tuesdays 11:00 AM – 12:00 PM,  
Wednesdays 11:30 AM – 12:30 PM and by appointment

II. Course Description and Objectives

Description  Modern techniques for preparative and analytical separations will be examined in terms of basic theory, instrumentation, and practical applications. Emphasis is placed on chromatography, electrophoresis, and mass spectrometry. Topics will be explored through a combination of scientific readings, case studies, and independent projects.

Learning Goals and Objectives

• Develop an understanding of the fundamental principles of analytical separations.
• Gain practical knowledge of chromatography, electrophoresis, and mass spectrometry instrumentation.
• Understand how to apply preparative separations and sample clean-up in chemical analysis.
• Interpret data from separation methods for the purpose of method development, validation, and quantitation.
• Select and apply the appropriate chromatographic and detection techniques for real-world analyses.
• Interpret and critically review scientific journal articles

III. Course Content and Resources

Topics  1. Introduction to Separations  
   a. Thermodynamic Basis for Separations  
   b. Preparative Separations: precipitation, filtration, extraction, and distillation
2. **Chromatography**
   a. General Theory and Background
   b. Gas Chromatography: theory, instrumentation, method development, GC x GC, applications
   c. Liquid Chromatography: theory, stationary phases, mobile phase preparation and optimization, instrumentation, sample preparation, applications
   d. Supercritical Fluid Chromatography: extractions and instrumentation, applications in sample preparation and preparative separations

3. **Electrophoresis**
   a. General Theory and Background
   b. Instrumentation
   c. Applications of Electrophoresis
   d. Lab-on-a-chip

4. **Detection Techniques**
   a. Mass spectrometry: instrumentation, fragmentation, data analysis, interfaces, high-resolution, and advanced techniques
   b. Other methods (as time allows): flame ionization, electron capture, conductivity, electrochemical

---

**e-Textbook**

Electronic resource available through the University of Iowa Libraries.

**Additional Recommended Readings**
Additional readings will be posted on ICON. A good textbook in analytical chemistry or instrumental analysis will provide you with basic knowledge of separation techniques to supplement course readings. The following resources are also recommended as references and are on reserve in the UI Libraries:

**Books**


Course Website
The course website is posted on ICON (http://icon.uiowa.edu). Login with your username and password. Announcements, syllabus, assignments, and readings will be posted here. All assignments and written work must be submitted through the ICON drop box. Please visit this website frequently for announcements and updates that may contain pertinent and/or clarifying information.

Other Resources
The University of Iowa Libraries (to access e-books and journal holdings); http://www.lib.uiowa.edu/
The Writing Center, 110 English Philosophy Building; (319) 335-0188; http://www.uiowa.edu/~writingc

IV. Grading

Grading Scheme

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem sets</td>
<td>20%</td>
<td>or 100 points</td>
</tr>
<tr>
<td>Sustainability presentation</td>
<td>10%</td>
<td>or 50 points</td>
</tr>
<tr>
<td>Article presentation</td>
<td>10%</td>
<td>or 50 points</td>
</tr>
<tr>
<td>Exam 1</td>
<td>20%</td>
<td>or 100 points</td>
</tr>
<tr>
<td>Exam 2</td>
<td>20%</td>
<td>or 100 points</td>
</tr>
<tr>
<td>Final project presentation</td>
<td>10%</td>
<td>or 50 points</td>
</tr>
<tr>
<td>Participation</td>
<td>10%</td>
<td>or 50 points</td>
</tr>
</tbody>
</table>

Final grades will be based upon points earned in the above categories. Plus or minus grades will be appended to letter grades. The grade of A+ will be awarded only in extraordinary circumstances.

Problem sets will cover course content and will be assigned at regular intervals. These assignments are designed to provide practice in key concepts and calculations and prepare students for exams.

For the sustainability presentation, students will research and present to the class a recent advancement in preparative separation science that aligns with the principles of green chemistry.

During the semester, each student will be assigned an article to present and critically review.

Exams will be cumulative, exam dates are noted below.
The final project consists of an oral presentation on a topic of your choosing in separations.

Participation will be assessed through student engagement in classroom activities and discussions, asking/answering questions, preparedness for class, and pop-quizzes.

Re-grading Adjustments to grades will only be considered within one week after an assignment or exam is returned. The re-grade request must be accompanied by a written, detailed description of the grading concern. Re-grading will involve re-assessment of the entire assignment and may increase or decrease the grade.

Attendance Attendance at class is mandatory for exams and student presentations. If you have to miss class on one of these days, notify the instructor in advance by completing the Explanatory Statement for Absence form and submitting it electronically to betsy-stone@uiowa.edu.

Key Dates Sustainability presentations February 17 and 19
Exam 1 March 25
Exam 2 April 29
Final project presentations May 4, 6, and TBA

Collaboration The homework for this course is designed to help you master knowledge related to separations. As such, students may initially discuss their approach to homework assignments with their peers. The work you turn in should be unique, meaning additional collaboration is not allowed. Do not share your work with others or ask others to see their completed assignments because both are considered academic misconduct. If you need help, please meet with the instructor. Students are responsible for understanding this policy; if you have questions, ask for clarification.

V. Administrative Details

Chemistry Center Chemistry Building E225
(319) 335-1341

Department of Chemistry Office Leonard MacGillivray, Departmental Executive Officer
Chemistry Building E331
(319) 335-1350

Absences and Attendance Students are responsible for attending class and for contributing to the learning environment of a course. Students are also responsible for knowing their course absence policies, which will
vary by instructor. All absence policies, however, must uphold the UI policy related to student illness, mandatory religious obligations, including Holy Day obligations, unavoidable circumstances, or University authorized activities (https://clas.uiowa.edu/students/handbook/attendance-absences). Students may use this absence form to aid communication; the instructor will decide if the absence is excused or unexcused.

<table>
<thead>
<tr>
<th>Academic Integrity</th>
<th>All undergraduates enrolled in courses offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty. Misconduct is reported to the College, resulting in suspension or other sanctions, with sanctions communicated with the student through the UI email address (<a href="https://clas.uiowa.edu/students/handbook/academic-fraud-honor-code">https://clas.uiowa.edu/students/handbook/academic-fraud-honor-code</a>).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accommodations for Disabilities</td>
<td>UI is committed to an educational experience that is accessible to all students. A student may request academic accommodations for a disability (such as mental health, attention, learning, vision, and physical or health-related condition) by registering with Student Disability Services (SDS). The student is then responsible for discussing specific accommodations with the instructor. More information is at <a href="https://sds.studentlife.uiowa.edu/">https://sds.studentlife.uiowa.edu/</a>.</td>
</tr>
<tr>
<td>Administrative Home of the Course</td>
<td>The College of Liberal Arts and Sciences (CLAS) is the administrative home of this course and governs its add/drop deadlines, the second-grade-only option, and related policies. Other colleges may have different policies. CLAS policies may be found here: <a href="https://clas.uiowa.edu/students/handbook">https://clas.uiowa.edu/students/handbook</a>.</td>
</tr>
<tr>
<td>Communication and the Required Use of UI Email</td>
<td>Students are responsible for official correspondences sent to the UI email address (uiowa.edu) and must use this address for all communication within UI (Operations Manual, III.15.2).</td>
</tr>
<tr>
<td>Complaints</td>
<td>Students with a complaint about an academic issue should first visit with the instructor or course supervisor and then with the Chair of the department or program offering the course; students may next bring the issue to the College of Liberal Arts and Sciences. For more information, see <a href="https://clas.uiowa.edu/students/handbook/student-rights-responsibilities">https://clas.uiowa.edu/students/handbook/student-rights-responsibilities</a>.</td>
</tr>
<tr>
<td>Final Examination Policies</td>
<td>The final exam schedule is announced around the fifth week of classes; students are responsible for knowing the date, time, and place of a final exam. Students should not make travel plans until knowing this information. No exams of any kind are allowed</td>
</tr>
</tbody>
</table>
the week before finals. Visit [https://registrar.uiowa.edu/final-examination-scheduling-policies](https://registrar.uiowa.edu/final-examination-scheduling-policies).

**Nondiscrimination in the Classroom**

UI is committed to making the classroom a respectful and inclusive space for all people irrespective of their gender, sexual, racial, religious or other identities. Toward this goal, students are invited to optionally share their preferred names and pronouns with their instructors and classmates. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories set forth in the University’s Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity ([diversity.uiowa.edu](http://diversity.uiowa.edu)).

**Sexual Harassment**

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community must uphold the UI mission and contribute to a safe environment that enhances learning. Incidents of sexual harassment must be reported immediately. For assistance, please see [https://osmrc.uiowa.edu/](https://osmrc.uiowa.edu/).

*These CLAS policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.*