I. Logistics

Instructor  Professor Betsy Stone
Chemistry Building W376
(319) 384-1863
betsy-stone@uiowa.edu

Class Location/Time
Chemistry Building E215 CB
Mondays and Wednesdays 3:30 – 4:45 PM

Office Hours
Mondays and Wednesdays 4:45 – 5:30 PM (following class)
Thursdays 1:30 – 3:00 PM and by appointment

II. Course Description and Objectives

Description
Modern techniques for analytical separations will be examined in terms of basic theory, instrumentation, and practical applications. Emphasis is placed on gas and liquid 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 and mass spectrometry instrumentation.
- Understand how to apply extractions 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 and filtration, extraction, 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, 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: [http://site.ebrary.com/lib/uiowa/Top?id=10299832](http://site.ebrary.com/lib/uiowa/Top?id=10299832)

**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:

**Books**


Journals

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>Assignment</th>
<th>Percentage</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Assignments (4)</td>
<td>20%</td>
<td>or 100 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</td>
<td>20%</td>
<td>or 100 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.

Four assignments will cover a) separation theory and preparative separations, b) gas chromatography, b) liquid chromatography, c) capillary electrophoresis.

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

Exams will be given at mid-term and finals.
The final project consists of a written report and presentation on a topic 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 of 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 through the ICON dropbox.

Key Dates

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>March 7</td>
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<tr>
<td>Exam 2</td>
<td>April 18</td>
</tr>
<tr>
<td>Final Project</td>
<td></td>
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<tr>
<td>Proposal Due</td>
<td>March 11</td>
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<tr>
<td>First Draft Due</td>
<td>April 8</td>
</tr>
<tr>
<td>Final Draft Due</td>
<td>April 22</td>
</tr>
<tr>
<td>Presentations</td>
<td>April 25, 27, May 2, 4</td>
</tr>
</tbody>
</table>

Collaboration
The homework for this course is designed to help you master your 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
Jim Gloer, Departmental Executive Officer
Chemistry Building E331
(319) 335-1350
### Administrative Home
The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook at http://clas.uiowa.edu/students/handbook.

### Electronic Communication
University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences (Operations Manual, III.15.2, k.11).

### Accommodating Disabilities
A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See www.uiowa.edu/~sds/ for more information.

### Academic Honesty
All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

### CLAS Final Examination Policies
The final examination schedule for each class is announced by the Registrar generally by the fifth week of classes. Final exams are offered only during the official final examination period. **No exams of any kind are allowed during the last week of classes.** All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of a final exam.

### Making a Suggestion or a Complaint
Students with a suggestion or complaint should first visit with the instructor (and the course supervisor), and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS Academic Policies Handbook).

### Understanding 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 have a responsibility to uphold this
mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Department of Public Safety website.