Syllabus for ANALYTICAL CHEMISTRY II: 4:112 (CHEM:3120:0001)
Spring 2015, Monday, Wednesday, Friday, 10:30-11:20 am in W228 CB

INSTRUCTOR
Prof. Amanda J. Haes
Office/Office Hours Location: 204 IATL
Office Hours: Mondays and Wednesdays from 8:30 – 10 am; or by appointment
Phone: (319) 384 – 3695
Email: amanda-haes@uiowa.edu
Grader: Tri Hoa Phan (hoa-phan@uiowa.edu)
DEO: Prof. Sarah Larsen, Department of Chemistry; Office: E331 CB; Phone: 335-1346/335-1350

DESCRIPTION OF COURSE
This course surveys and provides a theoretical description of modern spectroscopy and separation techniques. Specific topics in spectroscopy are atomic spectroscopy, molecular UV visible absorption and luminescence spectroscopy, vibrational spectroscopy, and mass spectrometry.

Prerequisite: CHEM:1120 (4:012), MATH:1460 (22M:016, Calculus for Biological Sciences) or MATH:1860 (22M:026, Calculus II), and PHYS:1512 (029:012, College Physics II) or PHYS:1612 (029.082, Introductory Physics II)

OBJECTIVES AND GOALS OF THE COURSE
Learning objectives for this course will focus on developing a fundamental understanding of the following topics as they relate to separations and spectroscopy.

- Understand the fundamental principles of, procedures used, and relevant terminology associated with separations and spectroscopy
- Relate knowledge and understanding to critically evaluate the function, use, and limitations of modern separations and spectroscopy
- Develop the intellectual skills to integrate theory and practice related to separations and spectroscopy to solve qualitative and quantitative problems with familiar and unfamiliar contexts
- Apply knowledge regarding the principles discussed to problems in separations and spectroscopy using mathematics (including statistics) and basic chemistry and physics concepts

TEXTBOOK

COURSE WEBSITE
http://icon.uiowa.edu (Access with your username and password) – lectures, homework, and up-to-date point totals will be available here. You may also be required to submit documents on this site.

GRADING SYSTEM AND THE USE OF +/-
Grades will be assigned and based on the distribution of point totals. The average score will likely lie at the B- /C+ border, and the overall grade distribution will approximately follow the College guidelines for advanced courses (22% A, 38% B, 36% C, 3% D, 1% F). The +/- grading scale will be used. Exceptional performances will receive an A+.

EXAMS, ASSIGNMENTS, AND PERCENTAGE OF FINAL GRADE
The course grade will be determined from the following elements:

- In-class quizzes – 2@60 points = 120 points (20%)
- In-class exams – 2@120 points = 240 points (40%)
- Final exam = 150 points (25%)
- Homework - ~3-4 assignments = 90 points (15%)
- Total = 600 points
COURSE POLICIES REGARDING EXPECTATIONS, ATTENDANCE, ABSENCES

- A 3 hour class typically entails at least 2 hours of outside preparation for the average student per each hour spent in class. You are expected to study an additional 6 hours/week outside of class.
- Attendance on quiz and exam days is required. Attendance on other days (except day 1) is neither taken nor required but encouraged. If you have to miss class on an exam or quiz day, please notify me in advance by filling out the form “Explanatory Statement for Absence of Class” and submitting it to me electronically (via email).
- There will be no make up opportunities for unexcused absences on exam/quiz days.
- Make up quizzes and exams must be scheduled BEFORE the original exam/quiz starts and taken within 48 hours of the originally scheduled exam/quiz time. Additional accommodations will be provided if warranted.
- Please silence all cell phones during class.
- Refrain from using electronic devices for non-course related purposes during class.
- Homework assignments will be announced in class and posted on ICON. Assignments will be due by the start of class one week later.

READING, SUGGESTED BOOK PROBLEMS, HOMEWORK, QUIZZES, EXAMS

- Reading and Suggested Book Problems: You are expected to read the assigned textbook sections and work through the suggested book problems (these should not be confused with graded homework problems). Suggested book problems will not be graded. I encourage you to solve the book problems in groups and independently as doing so will help you achieve the outlined learning objectives for the course. Additionally, portions of these questions will be used for questions on quizzes. Answers are available in the back of the book or an answer key is available to look at during the instructor’s office hours. Please note that some of the answers in the back of the book are incorrect. Working through other questions in the assigned reading and at the end of the chapters are also excellent methods for you to learn this material and demonstrate your expertise.
- Quizzes: There will be two in-class quizzes. You will be given 30 minutes to complete these. These quizzes are scheduled during class.
- Exams: There will be two in-class hour exams given during the course along with a comprehensive final exam. The final exam will consist of 120 points derived from all the course material and 50 points based on material covered after Exam #2. Sample exams are available on ICON.
- Homework: Graded homework assignments will be announced in class and posted on ICON. Assignments will be due by 10:30 am 1 week after the homework has been announced. You can discuss these homework sets as a group; however, copying work is not discussion. The written work must be individually prepared. Work that is copied from another individual is not acceptable and will result in a “0” for individuals enrolled in the course. Please see the section in the Student Academic Handbook on Rights and Responsibilities for the University of Iowa’s policy on academic misconduct: http://www.clas.uiowa.edu/students/handbook/x/.

A NOTE ON COLLABORATION

The graded homework assignments for this course are designed to help you master your knowledge related to the topics covered during lecture and in the textbook. As such, suggested book problems are not graded. In contrast, homework problems are turned in for credit and must represent your work and understanding (collaboration is not allowed on what you turn in for credit). Do not share your completed work with others or ask others to see their completed assignments because both are considered academic misconduct. Students are responsible for understanding this policy; if you have questions, ask for clarification.

A WORD ABOUT THE DATE AND TIME OF THE FINAL EXAM

The final examination date and time will be announced by the Registrar generally by the tenth day of classes. I will announce the final examination date and time for this course at the course ICON site once it is known. Do not plan your end of semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam.
CALENDAR OF COURSE QUIZZES AND EXAMS
Important Course Deadlines (These will take place during class unless noted. Your attendance is mandatory on these days.)
- February 4………Quiz 1 (Material covered through February 2)
- February 20………Quiz 2 (Material covered through February 18)
- March 9…………..Exam 1 (Material covered through March 6)
- April 15….………..Exam 2 (Material covered through April 13 and after Exam 1)
- TBA………………Final Exam (Material covered throughout the course, Time and Place TBD)

COURSE TOPICS, RELEVANT READING, AND SUGGESTED HOMEWORK
Topics will be selected from and presented in the following order as time permits. Slides shown during class will be posted on ICON.

- **Lecture Pack 1: Course Overview and Brief Review**
  - Expected Reading: Chapters 1A-B, 1E
  - Topics include class introduction, course overview, analytical method, importance of scientific terminology and how this relates to course goals

- **Lecture Pack 2: Separations – Introduction, Gas Chromatography, HPLC, and Electrophoresis**
  - Expected Reading: Chapters 26, 27, 28, 30A-B
  - Suggested Book Problems: 26-14, 26-15, 26-16, 28-22, 30-5, 30-6
  - Topics include
    - Extractions, why do molecules separate and what does this have to do with kinetics and thermodynamics?, define retention parameters and use these to compare/contrast the effectiveness of a separation, real world limitations of separations, plate theory, column efficiency, mechanisms of band broadening, resolution
    - Introduction to gas chromatography, gas chromatography components (block diagram), stationary and mobile phases in gas chromatography
    - Introduction to liquid chromatography; why use liquid chromatography and high performance liquid chromatography; liquid chromatography separation efficiency, elution strength, block diagrams, columns, stationary and mobile phase selection, retention order, and detectors
    - Introduction to electrophoresis, mechanisms of separation in electrophoresis, compare and contrast separation mechanisms of gas chromatography, liquid chromatography, and electrophoresis

- **Lecture Pack 3: Spectroscopy A – Introduction, Electromagnetic Spectrum, Signal/Noise, Quantification, and Instrumentation**
  - Expected Reading: Chapters 6, 5A-C (to page 119), 13C3-C4, 1D (should be a review), 7A-E
  - Suggested Book Problems: 6-2, 6-3, 6-7, 6-8, 6-11, 5-8, 1-9, 7-12
  - Topics include
    - What is electromagnetic radiation?, light interactions of matter, quantifying light-matter interactions, energy, principle of superposition, methods of quantification (quick review), noise, spectrometer components (overview, excitation sources, blackbody radiation sources, lasers filters, monochromators, gratings, cells, detectors)

- **Lecture Pack 4: Spectroscopy B – Atomic and Molecular Spectroscopy**
  - Suggested Book Problems: 8-1, 9-14A, 13-1, 13-2, 13-5, 13-9, 14-8, 15-9, 16-1, 16-5, 16-6, 16-7, 16-9, 16-13, 16-14, 17-10, 18-3, 18-4, 18-7
  - Topics include
    - Introduction to atomic spectroscopy, atomizers, introduction to molecular spectroscopy, molecular spectroscopy theory, Beer’s law, instrumental components, theory of fluorescence and
phosphorescence, introduction to vibrational spectroscopy, classical vs. quantum treatment of vibrational spectroscopy, vibrational spectroscopy selection rules, introduction to infrared spectroscopy, qualitative and quantitative analysis using infrared spectroscopy, infrared spectroscopy instrumentation, introduction to Rayleigh and Raman scattering, quantitative analysis using Raman scattering, Raman scattering instrumentation

- **Lecture Pack 5: Mass Spectrometry – Introduction, Instrumentation, and Methods *(only if there is time)*
  - Expected Reading: Chapters 11A-B, 20A-C
  - Suggested Book Problems: 20-6, 20-7, 20-11
  - Topics include
    - Introduction to mass spectrometry, block diagram of a mass spectrometer, ionization sources and mechanisms, mass analyzers and resolution, detectors, state of the art mass spectrometers
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).

ACCOMMODATIONS FOR 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 tenth day 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.

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.