

Advanced Analytical Chemistry
CHEM 3220
Autumn Quarter 2016

Instructor: Keith Miller
Office: SGM 105
Contact info: phone: 303.871.7721; email: keith.miller@du.edu
Lecture Time/Location: MWF 10:00 – 11:50AM; Olin Hall 103
Office Hours: By arrangement
Web Site: Canvas will be used

REQUIRED COURSE ITEMS

Textbook: The official texts required for the course are all available electronically from Anderson Academic Commons. Textbook chapters that will be used are available electronically via our library. Links to these chapters, additional articles, selected readings, and websites will be posted on the Canvas site. You will be expected to read and/or access the Canvas site.

Computer: A computer will be required for presentations and report writing. In addition, some activities will require the use of spreadsheet software for statistical analysis. Each student is expected to have access to a computer to complete these course requirements.

COURSE DESCRIPTION

Advanced Analytical Chemistry, is a required course in the core curriculum of the Chemistry and Biochemistry graduate program; the course is also open to advanced undergraduate students. The course provides a broad coverage of analytical techniques used by chemists in research and industry. Since the course is only 10-weeks, all techniques cannot be covered in-depth. Time will be devoted, however, to specific techniques that are most commonly used by research and regulatory chemists – chromatographic and mass spectrometry techniques.

LEARNING GOALS OF THE COURSE

Students completing this course should demonstrate the ability to:

- Identify, evaluate and select the appropriate analytical instrumentation based on instrumentation limitations and measurement needs.
- Learn independently by exploring the scientific literature and textbooks using a variety of resources.
- Effectively communicate scientific information both verbally and in writing to a variety of audiences.

COURSE FORMAT

The course will be conducted in a modified lecture/seminar format. The reading assignments will be provided in advance via Canvas, and you will be expected to have completed them prior to class. Please come prepared to discuss the information. I will not go over every detail in the reading; rather, the reading will be used as a starting point for many of our class meetings. You will be expected to work independently and in groups to complete the variety of assignments detailed below.

GRADED ASSIGNMENTS

In addition to the readings provided throughout the quarter, a variety of assignments will be given to apply your knowledge of analytical instrumentation. These assignments are intended to directly support the course learning goals. The completion of a series of larger projects will be required: a science outreach project directly related to the forensic science theme of this year's *National Chemistry Week*, the design of water quality monitoring plan for the new pond being constructed in front of the engineering building, and a review of new analytical technique not covered in our course lectures. Details for each of these projects will be presented the first week of class with additional details posted on Canvas. Short assignments will include short oral presentations, calculation problems and summaries of scientific papers.

PARTICIPATION/ATTENDANCE

This course requires a significant amount of your participation! You will need to apply yourself both in and outside of assigned class periods. Thus, your participation and attendance will be graded. Attendance to all assigned class periods is expected and required. If you cannot attend class, please let me know in advance.

EXAMS

A midterm exam will be given during week 5, and a cumulative final will be given. **NO MAKE-UP EXAMS WILL BE ACCEPTED.** There is one exception to this policy. If you will be out of town for a University sanctioned function (e.g., athletic team or music group) or military service, you are responsible for making arrangements with Dr. Miller at least one week in advance to complete the exam prior to the scheduled date. If you miss the midterm exam, then your final exam will be counted twice to replace the missed exam.

GRADES

At the end of the quarter, you will be graded according to your performance on your participation and attendance, course assignments, exams, and presentations. Your final grade will be determined by weight-averages from the following contributions:

Participation/discussion/attendance	5%
Assignments	15%
Course projects	25%
Midterm exam	25%
Final exam	30%
Total	100%

Your final grade will be determined by the scale below. The values listed in the table are the guaranteed minimum values. So, if your average is 90, you will receive an A- for the course.

	A		B			C			D		
Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	D-
Percentage minimum	95	90	86	82	77	74	70	65	61	57	55

CELLULAR PHONE AND LAPTOP POLICY

I respect the need for each individual to stay in contact with family and friends. The use of cellular phones, however, is disrupting to the learning environment. Thus, I request that the ringers of all cellular phones be muted during class. If an emergency arises, and you need to make a call on your phone, I request that you quietly leave the room and conduct your conversation out in the hallway. Laptops are **ONLY** used for taking notes, researching and reading literature related to the course, and conducting experiments will be allowed.

LECTURE AND TESTING ACCOMODATIONS. I will make every effort to accommodate students diagnosed with a learning disability. I will do this in complete confidence. I do, however, request that any student requiring these accommodations inform me the first week of class. For further information, please see the University Disability Services' website at <http://www.du.edu/disability/dsp/index.html>.

RELIGIOUS ACCOMODATIONS. It is University policy to grant students excused absences from class or other organized activities for the observance of religious holy days, unless the accommodation would create an undue hardship. I will do my best to accommodate your requests if you make arrangement with me *in advance* of your absence. Please examine the course syllabus, including the tentative schedule, for any potential conflicts with holy days and notify me prior to the end of the second week of classes of conflicts that may require your absence from class and/or prevent you from completing an assignment. More information can be found at: <http://www.du.edu/studentlife/religiouslife/about-us/policy.html>.

ACADEMIC DISHONESTY. While I advocate collaborative learning and teamwork, I also firmly believe that each individual should maintain the highest ethical standards in all of life's endeavors. As such, I support and will strictly enforce the Honor Code of the University of Denver. For your reference, the link to the Honor Code Student Conduct Policy and Procedures is:

<http://www.du.edu/studentlife/studentconduct/>.

IMPORTANT DATES

September 16 Project workday
October 3 Article/topic review approval
October 14 Midterm Exam
October 16-22 National Chemistry Week
November 21 Final Exam – 10:00 to 11:50 AM

TENTATIVE COURSE OUTLINE (9.11.2016)

- A. Introduction
 - a. Analytical process
 - b. Basic instrument design/selection
- B. Separation science
 - a. Introduction to chromatography
 - b. Gas chromatography
 - c. Liquid chromatography
 - d. Capillary electrophoresis
- C. Mass spectrometry
 - a. Ionization sources
 - b. Mass analyzers/detectors
- D. Spectroscopic techniques
 - a. Ultraviolet/visible
 - b. X-ray fluorescence (XRF)
- E. Hyphenated-techniques
 - a. Gas chromatography-mass spectrometry
 - b. Liquid chromatography-mass spectrometry
- F. Chemometrics