Pioneer Analytics Training Course
"CHEM 3210 – Instrumental Analysis"
Spring Quarter, 2006

Instructor:	Asst. Professor Keith Miller
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Lecture Time/Location:	MW 1:00PM – 1:50PM; Olin 103
Lab Times/Location:	MW 2:00PM – 4:50PM, or TR 1:00PM – 3:50PM; Olin Room 235
Office Hours:	By arrangement
Web Site:	Blackboard website

REQUIRE COURSE ITEMS

Textbook:	*Contemporary Instrumental Analysis* (2000) Kenneth A. Robinson and Judith F. Robinson (available at the DU Bookstore).
Lab Manual:	*Pioneer Analytics Training Manual* (2006) Keith E. Miller (handed out the first week of class). Updates and additions periodically distributed throughout course.
Calculator:	An inexpensive calculator is required. It should have the capabilities for square roots, logarithms, and exponential (scientific) notation operations. The calculator will be used for problem sets, worksheets and exams. You are responsible for understanding how to perform each of the operations on your calculator.
Computer:	We will use your laptop computers in both the lecture and laboratories. You should bring your laptop to all laboratories. I will inform you by email or during class meetings when your laptop will be require in lecture. ***If you have a Macintosh computer, please inform me as soon as possible.***
Goggles/Clothing:	Goggles are required for the laboratory. Goggles must be worn at all times when handling chemicals, heating glassware, or working with pressurized fluids. Appropriate clothing must be worn at all times in the laboratory. This includes closed-toed shoes and pants (a lab coat, of appropriate length, can be worn over shorts or skirts to fulfill the pant requirement). Students not having the appropriate clothing or goggles will be directed to leave the laboratory. ***(Note: see late policy later in syllabus)***

Remember to bring your calculator (or laptop) with you to every class.

COURSE DESCRIPTION

This course is primarily focused on understanding the operation principles of modern chemical instrumentation. The instrumental techniques that are emphasized include optical spectroscopy, mass spectrometry, chromatography, and potentiometry. The fundamentals of instrument operation will be the focus of the lecture portion of the course. In the laboratory, students will gain hands-on experience on the most common instrumentation used in industry today. Finally, students will have the opportunity to connect the laboratory with a real-world application through the completion of an integrated laboratory project.

LECTURE

The lecture format of class meetings will be a combination of traditional lecture format and group activities. During lecture, I will summarize new material and present illustrations and examples. In lecture, I WILL NOT identify and describe every detail you will read in the text and any supplemental materials. I will, however, emphasize the important topics covered in the reading as well as problem solving strategies when appropriate. You should stop me at any time if you have questions about the material being covered.

It is my goal that all lectures be conducted in an active learning environment. Therefore, we will stop periodically and apply what we have just covered. At times, I will ask you to work with other students to solve problems or answer questions. Early in the quarter I will assign individuals to groups. These groups will work periodically together during class on worksheets that cover course material. I encourage you to make the most of these interactions. Experience has shown me that other students often succeed in describing chemistry concepts where professors and instructors fail.

READING AND PROBLEMS

You are expected to complete the assigned reading prior to the class lecture. After lecture, you should reread the assigned text. I recommend that you understand the material and how to solve the sample problems before proceeding to the next section. The assigned reading is listed in the tentative schedule for the course. As the quarter progresses, topics and assigned reading may change. I will inform you immediately of changes in the suggested reading assignments. I will assign problems from the textbook weekly, and strongly suggest that you complete the problems. While you are not required to turn the completed problems in for a grade, I highly recommend that you attempt all of them.

KNOWLEDGE ASSESSMENT

An assessment of your chemistry knowledge will be performed early in the course. The purpose of this evaluation tool is to establish your current knowledge of chemical principles. The outcome of this assessment is important as it will aid in the evaluation of the chemistry courses that you have completed prior to this course. The assessment will be conducted electronically outside of class. While you will not be assigned a grade from your score, completion of the assessment is mandatory. Once the assessment is available electronically, you will be given two (2) weeks to complete it for full credit.

ATTENDENCE POLICY

We will cover a large quantity of information in lecture and laboratory during the course. Thus, attendance is mandatory. Attendance will be taken both in lecture and laboratory. Missing three (3) classes will result in the automatic lowering of your grade by two increments (for example, A- to B), and will be cumulative. Being late (of which I define as not being in class or lab by 5 minutes after the official start time) will also be noted in both lecture and laboratory. Every three (3) late arrivals will count as a missed class. Not completing your pre-lab assignment before your scheduled laboratory will also count as a late arrival. Arrival in laboratory after one (1) hour from the designated start time has passed will count as a missed class.

GRADED EXERCISES

While the suggested problems will not be graded, various activities throughout the quarter will be assigned and collected for grades. The expected activities are detailed below, but modifications might be made during the quarter to enhance the learning experience.

1. Group work – Groups will work together on several exercises, each designed to further your understanding of the course material. The exercises will be performed during lecture and outside of class (possibly in lab during "down time"). One assignment will be submitted by each group, and all members in the group will receive the same grade. At the end of the quarter, however, a portion of your grade will be based on your participation in these group activities. This grade will be based partially on my observations and those of your peers within your group. The projected activities are:

    a. Worksheets – One-page worksheets will be started during lectures periodically. I will announce what day I plan on devoting to worksheets well in advance. If you cannot attend, you must coordinate with the other members of your group to complete (or significantly contribute to the completion) the worksheet prior worksheet collection.
    b. Exam key – After the midterm exam, each group will meet together to develop an answer key for the exam. This key will be due prior to the return and review of the exams. I will post the instructor's key after the group keys have been submitted. The keys will be due at the start of the second class period after the midterm exam. If all keys are submitted early, I will return the graded exams early.

2. I will assign due-dates for all of these graded assignments. A 10% penalty will be assessed on all assignments turned in late. An additional 10% penalty will be assessed for each additional class meeting period the assignment is late.

LABORATORY: EXPERIMENTS AND REPORTS

Laboratory experiments in this course will completed on a rotational basis. The intent of the first half of the course is to "certify" each analyst on the major analytical instruments that we have available. During the first week, an introduction to each instrument will be given, lab partners will be selected, and software will be installed on your laptops (if required). During weeks 2 – 5, groups will rotate through four (4) different experiments. The rotation will be posted after lab partners have been selected. During week 6, all groups will complete the same lab and be assigned a group project. During weeks 7 – 10, three to four (3-4) advanced experiments will be completed. These projects will be based on actual enforcement activities or analytical requests from outside entities. Portions of these advanced experiments will require work outside of the designated meeting times that will need to be coordinated in advance. If you are unable to attend your assigned laboratory section, you must inform me.

Laboratory reports will be required for all experiments. Further instruction for the actual format is included in the laboratory manual. I will assign a due-date for the submission of completed reports. Each report for laboratories 1 – 6 will be worth 50 points. The reports for the advanced experiments will be worth a total of 150 points. Late reports will be assessed a 10% penalty. Although students work together performing the experiments and collecting data, the laboratory reports are an individual effort. I encourage you to work together to interpret your results and formulate your conclusions. However, reports that are merely a duplication of each other will not be graded, resulting in "0" points assigned. ***Your performance in lab groups will be evaluated***

by the GTA, your lab partners and me. A portion of your overall grade will be assigned to reflect your performance in the laboratory.

EXAMS

A midterm exam and a cumulative final exam will be given during the quarter. Exam problems will be similar to the problems from the worksheets and the suggested problems. Questions relating to each of the laboratories will also be included on the exams. If you will be out of town for a University sanctioned function (e.g., athletic team or music group), you are responsible for making arrangements with Dr. Miller at least one week in advance to take the midterm exam early. **THERE WILL BE NO MAKE-UP MIDTERM EXAM.**

GRADES

This lecture and laboratory are all part of one course. Thus, at the end of the quarter, you will be graded according to your performance on the graded exercises, examinations, and laboratory reports. Your final grade will be determined by the following scale:

Knowledge assessment	3%
Graded exercises/participation	12%
Midterm exam	20%
Final exam	20%
Laboratory Reports	45%
Total	100%

CELLULAR PHONE AND PAGER POLICY

I respect the need for each individual to stay in contact with family and friends. The use of cellular phones and pagers, however, is disrupting to the learning environment. Thus, I request that the ringers of all cellular phones and pagers 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.

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.

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, I have included the links for the Honor Code Statement and Honor Code Procedures for Students below. For further information, please see the Office of Citizenship & Community Standards' website at http://www.du.edu/honorcode/statement.htm for the Honor Code Statement and at http://www.du.edu/honorcode/studentprocedure.htm for the Honor Code Procedures for Students.

TENTATIVE SCHEDULE

Meeting	Date	Topic	Text Chapter
1	Mar 27	Lecture: Introduction/Course overview	1.1 – 1.5
2	Mar 27/28	Lab: Check-in; Safety brief Lab experiments 1-5 overview	
3	Mar 29	Lecture: Introduction to optical spectroscopy	8.1 – 8.3, 8.8
4	Mar 29/30	Lab: Statistics Experiment 1	2.1 – 2.13
5	Apr 3	Introduction to Chromatography; Statistics (cont)	13.1 – 13.5 2.14 – 2.16, 3.1 – 3.5
6	Apr 5	Calibration, noise and detection limits	4.1 – 4.7, 5.5 – 5.7
7	Apr 10	Atomic adsorption	9.1 – 9.9, 9A
8	Apr 12	Atomic emission	
9	Apr 17	Molecular adsorption	8, 8A – 8C
10	Apr 19	Molecular emission	
11	Apr 24	**Midterm Exam**	
12	Apr 26	Infrared Spectrometry	10.1 – 10.4, 10.6 – 10.8
13	May 1	Electrochemical Methods	7.1 – 7.4
14	May 3	Chromatography	13.1 – 13.5 (review); 13.6 – 13.10
15	May 8	Liquid chromatography	14.1 – 14.10
16	May 10	Gas chromatography	15.1 – 15.5, 15A, 15B
17	May 15	Mass spectrometry – basics	12.1 – 12.12, 12A; handout
18	May 17	Mass spectrometry – advanced	
19	May 22	Capillary Electrophoresis	16.1 – 16.6
20	May 24	Chemometrics	Handout
--	May 29	**Memorial Day – No class**	
21	May 31	Chemometrics	Handout
--	June 2	**Review (optional)**	
--	June 5	**Final Exam -- 1:00 to 2:45 PM**	