Course Syllabus Chem 5730: Advanced Analytical Chemistry

Fall 2016
MWF 10:00-10:50 Chem 304
W 12:00-12:15 Chem 305
Final Exam: **Fri. Dec. 9, 2016 9 am-12 pm, Room 304**

Instructors:
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Office hours:

The purpose of this course is to introduce the student to analytical instrumentation and provide the student with practical information that they can apply in their research. The course covers various families of instrumentation including electrochemistry, separations, mass spectrometry, and optical spectroscopy. A final unit integrating techniques in surface science will also be included. Emphasis will be on designing experiments, understanding instrumentation, learning how to make meaningful measurements and interpreting results. At the end of the course, the student will have a better understanding of basic instrumentation and be able to better design analytical experiments.

Grading: The guaranteed grading scale is A=>90 % and B => 80 % etc. However, the scale may be adjusted downward if necessary. A grade of C or below is considered failing for graduate students. In general, students consistently scoring outside of one standard deviation below the class average should seek assistance. Grades will be weighted as follows:
Exam 1: 20 %
Exam 2: 20 %
Final Exam: 30 %
Final Project: 15 %
Writing/Presentations: 12 %
Discussion Section Exercises: 3 %

Honor System: I trust every student in this course to fully comply with all of the provisions of the UVA honor system. Alleged honor violations will be forwarded to the Honor Committee. If, in my judgment, it is beyond a reasonable doubt that a student has committed an honor violation with regard to a given exam, that student will receive an immediate grade of 'F' for that exam, irrespective of any subsequent action taken by the Honor Committee. Students must follow the given rules for the take-home exam and must properly cite references and avoid plagiarism in their paper. Violations of these guidelines will result in a failing grade.

If you believe you may have committed an Honor Offense, you may wish to file a Conscientious Retraction ("CR") by calling the Honor Offices at (434) 924-7602. More information can be found at www.virginia.edu/honor.

Attendance: Attendance at all class sessions is expected.

Course materials: Course website is in Collab. You can get there off the Virginia homepage (www.virginia.edu), and logging in using your NetBadge should bring up the class if you are registered. Problem sets, example tests, and articles will be posted on this website in the Resources section.

The required textbook is:
Principles of Instrumental Analysis, 6th edition by Skoog, Holler, Crouch (copyright 2007)
You can get cheaper used versions of this book online than in the bookstore.

Students needing accommodations:
All students with special needs requiring accommodations should present the appropriate paperwork from the Student Disability Access Center (SDAC). It is the student's responsibility to present this paperwork in a timely fashion and follow up with the instructor about the accommodations being offered. Accommodations for test-taking (e.g., extended time) should be arranged at least 7 days before an exam.

The SDAC is located in the Department of Student Health and can be contacted at 243-5180/5181.

Tentative Schedule of MWF 10 am class meetings

Aug. 24	Intro
Aug. 26	Figures of Merit, Overview of Techniques
Week of Aug. 29	Electrochemistry (Ch. 22, 23) **Venton**
Aug. 29	Intro to Electrochemistry
Aug. 31	Electrochemistry basics, Nernst equation
Sept. 2	Potentiometry/pH electrodes
Week of Sept. 5	Electrochemistry (Ch. 24, 25) Separations (Ch. 26) **Venton**
Sept. 5	Voltammetry
Sept. 7	Coulometry/Instrumentation
Sept. 9	Intro to Separations
Week of Sept. 12	Separations (Ch 26, 27) **Venton**
Sept. 12	Chromatography Theory pt. 1
Sept. 14	Chromatography Theory pt. 2
Sept. 16	Gas Chromatography
Week of Sept. 19	Separations (Ch. 28, 29, 30) **Venton**
Sept. 19	Liquid Chromatography
Sept. 21	Capillary Electrophoresis
Sept. 23	Extraction/supercritical Fluid Chromatography

(End of Material for 1st exam)

Week of Sept. 26	Spectroscopy, Instrumentation (Ch. 6) **Metcalf**
Sep. 26	Introduction to Spectroscopy (atomic vs molecular)
Sept. 28	Properties of electromagnetic radiation
Sept. 30	**Exam 1-In class**
Week of Oct 3	Spectroscopy Instrumentation (Ch. 7) **Metcalf**
Oct. 3	**Fall break no class**
Oct. 5	Spectroscopy Instrumentation-light sources/lasers/filters
Oct. 7	Spectroscopy Instrumentation-detectors
Week of Oct. 10	Atomic Spectroscopy, UV-Vis (Ch. 9, 10, 13) **Metcalf**
Oct. 10	Atomic Absorption
Oct. 12	Atomic Emission
Oct. 14	Intro to UV-Vis
Week of Oct. 17	Molecular Absorption Spectroscopy (Ch. 14, 16, 17) **Metcalf**
Oct. 17	Molecular UV-Vis
Oct. 19	IR spectroscopy
Oct. 21	IR spectroscopy/Fourier Transforms
Week of Oct. 24	Molecular Emission Spectroscopy (Ch. 15, 18) **Metcalf**
Oct. 24	Fluorescence Spectroscopy
Oct. 26	Other Luminescence techniques
Oct. 28	Raman Spectroscopy
(End of Material for 2nd exam)	
Week of Oct. 31	Mass Spectrometry (Ch. 11, 20**) Venton**
Oct. 31	Intro to Mass spectrometry
Nov. 2	Mass Spec ionization
Nov. 4	**Exam 2-in class**
Week of Nov. 7	Mass Spectrometry (note: book is weak here so will provide other resources) **Venton**
Nov. 7	Mass spectrometry ionization
Nov. 9	Mass spectral interpretation
Nov. 11	Mass spectrometry detectors
Week of Nov. 14	Mass Spectrometry, Surface Chemistry (Ch. 20, 12, 21)
Nov. 14	Mass spectrometry detectors, MS/MS **Venton**
Nov. 16	Surface Analysis-Spectroscopy (Ch. 12?, 21) **Metcalf**
Nov. 18	Surface Analysis-Microscopy SEM **Metcalf**
Week of Nov. 24	Surface Analysis (Ch. 21)
Nov. 24	Surface Analysis-Microscopy AFM, STM, scanning probe **Metcalf**
Nov. 25	**No class-Thanksgiving**
Nov. 27	**No class Thanksgiving**
Week of Nov. 28	Surface Analysis, Student project presentations
Nov. 28	Surface Analysis-Mass spectrometry **Venton**
Nov. 30	Student Project Presentations
Dec. 2	Student Project Presentations

Week of Dec. 5 Mon. Dec. 7	Student Project Presentations
Fri. Dec. 9	**Final Exam 9-12 am**

Schedule of Wednesday 12 pm Discussion Section Meetings

Wed. Aug. 24	Overview of Class, Electronics Definitions
Aug. 31	DC and AC circuits (ch. 2)
Sept. 7	Semi-conductors/Transistors (Ch.2)
Sept. 14	Op amps (Ch.3)
Sept. 21	Reviewing day (1st writing assignment)
Sept. 28	Digital Electronics (Ch. 4) (1st paper due)
Oct. 5	Student presentations
Oct. 12	Student presentations
Oct. 19	Reviewing day
Oct. 26	Electronics paper/assignment (2nd paper due)
Nov. 2	Combined techniques paper/assignment
Nov. 9	Student presentations
Nov. 16	Student presentations
Nov. 23	Thanksgiving break
Nov. 30	Mass Spectrometry paper/assignment