CHM 311 Instrumental Analysis Lecture Syllabus Fall 2009

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Office Hours: TBA



Lecture:MWF 9:00 - 9:50

Lab: Tue 9:30 – 12:20

The aim of the course is to introduce you to the main methods of instrumental analysis. You will gain an understanding of the chemical principles behind the instrumental techniques, a working knowledge of instrument operation, and cognizance of the applications of instrumental analysis. Given the rapid growth in the type and complexity of chemical instrumentation, it would be difficult to cover every technique available. However, this course should provide you with the fundamental background on the workings of many important types of instruments that you will likely encounter in the future, including absorption and emission spectroscopy, electrochemical techniques, and chromatographic separation.

REQUIRED TEXT

Harris, Daniel C., *Quantitative Chemical Analysis*, 6th or 7th edition (W.H. Freeman, 2003/2006) ISBN 0-7167-4464-3.

This text is somewhat unconventional for an instrumental course. You will recognize it as last year's Analytical book. You might recall that during the Analytical course we actually covered less than half of the material contained in this text, the reason being that the second half of the book deals with instrumental techniques. Therefore, it seems reasonable to use what remains for an Instrumental course.

ATTENDANCE

The volume of material to be considered is large and of a cumulative nature. Therefore, it is important that you attend all scheduled class meetings. Please contact your instructor immediately if you know you will miss a lecture or especially a laboratory.

EXAMINATIONS AND COURSE GRADE

Your overall grade will be determined by computing your numerical grade according to the following:

| 2 Exams (12 % each) | 24% | |
|--------------------------|-----|--|
| Final Comprehensive Exam | 15% | |
| Weekly Quizzes | 10% | |
| Online assignments | 11% | |
| Talk(s) | 10% | |
| Laboratory | 30% | |

Homework problems will be selected from the end-of-chapter problems that appear in the text. Each examination will be announced at least one week before it is given. Examination questions will be drawn from lecture material, assigned readings, homework problems, and material covered in the laboratory. The final examination will be given during Final Examination Week and will be comprehensive.

TO SUPPLEMENT THE TEXT, COMPUTER BASED ASSIGNMENTS AND SIMULATIONS WILL BE GIVEN.

Short talks on various techniques/instrument components will periodically be assigned.

LABORATORY

A very important aspect of this course is the laboratory work. You will use many of the instruments discussed during class. You will work in groups of 2-3 depending on the class size. The first lab covering basic electronics will be performed during the second week of class. Subsequently, each group will carry out a different experiment in a given week due to the large student-to-instrument ratio. You are expected to read the appropriate background material in preparation for the laboratory before coming to class. The laboratory grade will be 30% of your final grade.

In order to pass the course, you must receive a passing grade in both the lecture and laboratory parts of the course.

TENTATIVE LECTURE SCHEDULE

| Week | Chapters & Topics | | | |
|------|-------------------|--|--|--|
| 1 | Ch. 18 | Fundamentals of Spectrophotometery Properties of light and it's interactions with matter (pg 408-410, 418-426) Beer's Laws (pg 410-413) | | |
| 2 | Ch. 20 | Signals and Noise (pg 487-488 and handouts) Light Sources (pg 462-465) Wavelength Selectors (pg 465-472 and handouts) Detectors/ Transducers (pg 472-480) | | |
| 3 | Ch. 19 Ch. 18 | UV/Visible Spectrophotometry (pg 434-437 and handouts) Molecular Fluorescence Spectrophotometry (pg 422-426) | | |
| 4 | Ch 21 | Atomic Absorption Spectrophotometry (pg 495-500) Atomic Emission Spectrophotometry (pg 501-513) | | |
| 5 | Ch. 20 | An Introduction to Infrared Spectrometry (pg 481-487) | | |

Midterm Examination I

| 6 | Ch. 22 | Molecular Mass Spectrometry Construction of a mass spectrometer (pg 518-522, 528-538) Ion formation and separation processes (pg 522-528 and handouts) Application and Spectral interpretation (pg 539-540) |
|--------|--------|--|
| 7 | Ch 23 | Introduction to Separation Methods Theory of chromatography processes (pg 553-563) Plate and Rate Theory (pg 563-570) |
| 8 9 | Ch 24 | Gas Chromatography Separation Processes (pg 579-587) Samples and Detectors (pg 587-598) Method Development (pg 598-600) |
| 10 | Ch 25 | High-Performance Liquid Chromatography Introduction (pg 609-614) Elution methods (pg 614-621) Injection and Detection (pg 621-626) Reverse Phase and Gradient Elution (pg 626- 634) |

Midterm Examination II

| 12 | Ch. 26 | Chromatographic Methods Ion Exchange Chromatography (pg 641-649) Size Exclusion Chromatography (pg651-653) |
|----------|--------|--|
| 13 | Ch. 27 | Capillary Electrophoresis (pg 654-661) |
| 14 15 | | Catch- Up week Final Examination |