# Chemistry 322
# Chemical Instrumentation
# Spring
# Syllabus

**Professor:** Brian J. Huffman

**Office:** FSB 315

**Lab:** FSB 315

**Class Web Site:** Lab notes, handouts, problem sets, and answer keys are available on the Angel website attainable through UNAPortal.

**Office Hours:** **MWF: 10-11 MW: 4-5 TR: 11-12**
During office hours, I may be found in my office or lab.

**Contact Information:** Phone: 765-4339: Email: bhuffman@una.edu

**Course Credit:** Three credit hours

**Course Prerequisites:** CH 311, 311L, 381, 381L

**Required Text:** Principles of Instrumental Analysis; Skoog, Holler, Crouch, 6th ed., 2007, Thomson Brooks/Cole

Spectrometric Identification of Organic Compounds, R. M. Silverstein, & F. X. Webster, 6th ed., 1998, Wiley

**Attendance Policy:** Students are strongly encouraged to attend every lecture of CH 322. Students who miss an exam or assignment due date will receive a score of zero for that exam or reduced credit for the assignment (5%/day). However, if the student knows of an upcoming absence the instructor should be notified prior to that absence via email, phone, or in person to make arrangements. Any illness should be documented afterwards by a physician's note.

**Missed Exams:** There will be **four** hour exams. A score of zero will be recorded for any missed exam as mentioned in the attendance policy. Upon prior notification or receipt of an acceptable excuse, either a make-up exam will be allowed or the final exam grade may be substituted. This policy will increase the effect of the final exam on the final grade each time an hour exam is missed. The purpose of this policy is to provide students with a reasonable alternative to receiving a zero on a missed exam, provided there is a good reason for missing the exam. It is not the purpose of this policy to allow students to pick and choose which exams they wish to take because of poor preparation. If the instructor has reason to believe that a student has missed an exam for any reason other than some unavoidable circumstance, such as illness, that student will receive a zero for that exam score. **Any student, who will miss an exam because of an official University event, must make arrangements at least one week before the exam to take the exam early.**

**Disabilities Policy:** In accordance with the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973, the University offers reasonable accommodations to students with eligible documented learning, physical and/or psychological disabilities. Under Title II of the Americans with Disabilities Act (ADA) of 1990 and Section 504 of the Rehabilitation Act of 1973, a disability is defined as a physical or mental impairment that substantially limits one or more major life activities as compared to an average person in the population. It is the responsibility of the student to contact Developmental Services prior to the beginning of the semester to initiate the accommodation process and to notify instructors within the first three class meetings to develop an accommodation plan. Appropriate, reasonable accommodations will be made to allow each student to meet course requirements, but no fundamental or substantial alteration of academic standards will be made. Students needing assistance should contact Developmental Services.

**Drop Dates:**

**03/12/2010: End of "W" period**

**04/21/2010: End of "WP/WF" period (last day to drop course/withdraw from University)**

Withdrawal from the University: Students who wish to withdraw from the University up to and including the Friday that falls one week after the designated midterm date must first notify the Office of the Registrar and follow official procedures. The grade of W will be recorded for each registered course. Withdrawal from the University after the Friday that falls one week after the designated midterm date requires consultation with the Office of the Dean of Enrollment Services. In cases where withdrawal from the University is unavoidable, such as a medical emergency, the grade of W will be uniformly recorded. In cases where withdrawal from the University is optional the student will receive grades of WP (withdraw passing) or WF (withdraw failing) assigned by the instructors. Withdrawal from a Course: A student may withdraw from a course with a grade of W up to and including the Friday that falls one week after the designated midterm date by bringing a completed withdrawal slip (signed by the instructor) to the Registrar's office. After that deadline and up to the Wednesday that falls two weeks prior to the last day of class, a student may withdraw from a course with a grade of WP (withdraw passing) or WF (withdraw failing) assigned by the instructor. During the final two weeks of class, withdrawal is not permitted except in extraordinary circumstances. Permission of both the instructor and department head is required, and the grade of WP or WF will be assigned by the instructor.

***Students dropping chemistry or industrial hygiene classes which require that laboratories be taken concurrently must also drop the corresponding laboratory course.**

**Course Description and Purpose:**

From the University Bulletin: "Principles of operation and application of instrumental methods of chemical analysis involving spectrophotometry, spectroscopy, electroanalytical methods, and chromatography."

This course is intended to satisfy the needs of students with a variety of interests. It is primarily a chemistry course that provides an introduction in methods of instrumental chemical analysis. This course is meant to provide a basic understanding of the more common instrumental techniques available to industrial and clinical chemists. After successfully completing this course (and the previous Quantitative Analysis course), a student would be well equipped to work in an industrial setting or to attend graduate or professional school. This course should be useful to students with career interests in biology, industrial hygiene and health care, as well as chemistry and engineering. In today's "high-tech" laboratories, most tests are performed by instrumentation. It is important for all technical professionals to have a sense of the accuracy and reliability of data generated by analytical laboratories. This course and laboratory may very well be the only chance that many students will have to gain this very valuable experience. In short, this course offers much to many different types of students. But, as with all courses, the student will gain only as much from the course as he is willing to put into it.

**Course Objectives:**

1. To understand and be able to **discuss** the following concepts for each instrumental technique covered:
    - Instrumentation including instrument schematics, description of each major instrument component (its function, how different types of components work).
    - Physical principle upon which the technique is based.
    - Applications of the technique.
    - Advantages and disadvantages of each technique, compared to other, similar techniques and what can be done about the disadvantages.
    - Qualitative abilities of the techniques.
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2. To be able to use the various calibration methods
3. To be able to interpret IR, MS, and NMR spectra.
4. To understand and be able to utilize the quantitative abilities of the various techniques.

5. To understand and be able to utilize the qualitative abilities of the various techniques.

**Learning Outcomes** Alabama Department of Education – In accordance with State standards, students completing this course should have a knowledge of the following:

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| 290-3-3-.17(1)(c)5. Knowledge of major biological compounds and natural products. |
| 290-3-3-.17(1)(c)13. Knowledge of applications of chemistry and chemical technology in society, business, industry, and health fields. |
| 290-3-3-.17(1)(c)14. Knowledge of principles of electrochemistry. |

*Each will be assessed on the comprehensive final exam.

**Topics Covered**

Introduction to Instrumental Analysis

Concepts:

- Basic instruments and components
- The relationship between analyte concentration and instrumental response
- Methods of calibration
- construction and use of calibration graphs
- theory and use of linear regression calibration curves
- theory, construction and use of standard addition curves
- Sensitivity and detection limits

Molecular Techniques**:**

- Ultraviolet - Visible (UV-Vis)
- Molecular Fluorescence
- Phosphorescence
- Chemiluminescence (CL)
- Infrared (IR)
- Nuclear Magnetic Resonance (NMR)
- Mass spectrometry (MS)

Atomic Techniques

- Atomic emission (AES)
- Atomic absorption (AAS or AA)

Chromatographic Techniques

- Gas chromatography (GC)
- Liquid chromatography (LC or HPLC)
- Planar chromatography

Electroanalytical Techniques

- Potentiometry
- pH meters
- Ion selective electrodes (ISE)
- Voltammetry

**Final Exam** The final exam will be a comprehensive exam given during the university assigned time during Finals week, 8:00-9:45 am, May 7th, 2010.

**Final Grade** Final grades will be calculated in the following manner:

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| Exams (3 full + 1 mini) | 390 pts |
| Presentation | 100 pts |
| Class Participation/Homework | 100 pts |

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|---|---|
| Final Exam | 200 pts |
| Total | 790 pts |