

Chemistry 424 Spring 2003

Syllabus and Course Information

Instructor and Class Information

Four hours. Prerequisites: CH 223 and 341 or approval of instructor. Two lectures, one five-hour laboratory. See the catalog for further information. *Note:* This course carries the University's writing (W) designation.

The class meets TR 11-11.50 am in Rm 230 of Lloyd Hall.

Instructor: Prof. S. C. Street Office #: 325 Lloyd
Email: ssstreet@bama.ua.edu Office Hours: TR 10-11 am or appointment
Website: <http://www.bama.ua.edu/~ssstreet/Instrumental%20Methods/CH424.html>

Objective

The purpose of this course is to provide students with knowledge of various modern methods of instrumental analysis in order to prepare them for industrial or academic careers. The course stresses quantitative rather than qualitative analysis, since this aspect of many of the techniques is covered in other chemistry courses. The material presented and the depth of treatment are intended to adequately prepare students for the ACS Graduate Placement Examination in Analytical Chemistry upon entry to graduate school. Additionally, students will receive instruction on the basics of scientific report writing.

Text

The primary text is Principles of Instrumental Analysis, 5th ed., by Skoog, Holler, and Nieman (Saunders College Publishing, Philadelphia, 1998). From time to time other texts may be brought to your attention. You are fortunate to have a reasonably clear and complete text for this course. Read it. You are responsible for all the material in each chapter covered unless otherwise noted. **READ THE BOOK.** You may also wish to have access to a manual on scientific report writing e.g., R.A. Day, How to Write and Publish a Scientific Paper, 3rd ed., Oryx Press, Phoenix AZ, 1988.

Course Content

Based on previous experience with this course, (tentatively) the following topics will be covered explicitly in CH 424.

- 1) Principles of measurement
- 2) Signal recovery
- 3) UV-Vis optical devices and spectrometers (2 lectures)
- 4) Spectrophotometric determinations
- 5) Fluorometric determinations

- 6) Atomic spectroscopy instrumentation
- 7) Atomic absorption methods
- 8) Atomic emission methods
- 9) Infrared instrumentation
- 10) Quantitative IR spectroscopy
- 11) Raman Spectroscopy
- 12) X-ray fluorescence methods
- 13) X-ray photoelectron spectroscopy
- 14) Auger electron spectroscopy
- 15) Nuclear magnetic resonance spectroscopy (2)
- 16) Radiation detectors
- 17) Neutron activation analysis
- 18) Mass spectrometry instrumentation
- 19) Applications of mass spectrometry
- 20) Principles of chromatography
- 21) Gas chromatography
- 22) High performance liquid chromatography
- 23) Introduction to electrochemical methods
- 24) Potentiometric instrumentation and techniques
- 25) Voltammetric instrumentation and techniques

Course Requirements and Grading

Class and laboratory attendance is mandatory. The student is expected to be prepared for a given lecture topic by having read the relevant chapter in the text *before* the lecture is given. Performance in the lab and the classroom will be graded. The student should work all problems in the body of the text and any others recommended by the instructor. Progress will be monitored by announced quizzes throughout the course of the semester (~ 7 in total). The students will be required to prepare and present material orally in class. The final exam will be an ACS DivCHED comprehensive examination, which is used as a graduate entrance exam by The University of Alabama. Grades will be assessed by comparison with the nationally established norms made available with the examination. Subject to the overriding requirement imposed by this course's W designation (see below), any student scoring in the top 90% of the national norms will receive a grade of A regardless of any other scores. Similarly, students scoring in the top 80% and 70% will receive a B or C, respectively, if this is better than the overall grade would be otherwise.

Grading will be based on the accumulation of points according to the following:

Laboratory reports	30 pts
Laboratory performance	10 pts
Class performance	10 pts
Best 5 quizzes	30 pts
Final (ACS DivCHED) Exam	<u>20 pts</u>
TOTAL	100 pts

Laboratory

The purpose of the laboratory is to demonstrate some of the instrumental techniques studied in the lecture section of the course and familiarize the student with the instrumentation itself. It also serves to provide instruction in the principles of analytical calibration, measurement, and error analysis. Note that the procedures involved tend to be idealized; “real-world” problems of sampling protocol, preparation, contamination and matrix effects (interferences) are often the limiting factors in practical applications of these techniques.

Experimental descriptions and other course information are available on the website. In addition to safe practice and the completion of the required laboratory experiments, the student will submit lab reports detailing results (including error assessments) and answers to questions posed in the experimental description and by the teaching assistant. Because this course carries the W (writing) designation, satisfactory completion of the written laboratory reports is absolutely necessary before a passing grade can be issued. This means that the reports must be written in *coherent, logical, and carefully edited prose*. It will be required that at least two (but not more than three) of these reports, chosen by the instructor, shall be written in an appropriate format suitable for submission to a refereed journal. The instructor is willing and able to instruct students in scientific writing skills. Students may wish to consult the *ACS Style Guide* published by the American Chemical Society. More information on the nature of these reports will follow.

Appropriate safety precautions and practices shall be observed at all times.

Use a hard-backed, bound notebook for record keeping in the lab (the kind with ruled squares is recommended). Use a blue or black ball-point pen for notes. Each page of the notebook should be numbered and dated. The teaching assistant will check, initial, and date each lab period's entry.

The University Honor system is in full force for all aspects of this course. In certain cases group work is encouraged (working on problems) or even required (the lab). However, you know the difference between working in study groups on a problem set and simple copying of answers. For the recognition of this essential difference you are on your honor.

Academic misconduct: All acts of dishonesty in any work constitute academic misconduct. The Academic Misconduct Disciplinary Policy will be followed in the event of alleged academic misconduct.