

Instructor: Martin Ondrus

Lecture: 9:05 - 10:00 Monday SW - 309

Laboratory: 8:00 - 11:05 Wednesday and Friday SW - 309

Texts: Quantitative Chemical Analysis, 6th Ed. Daniel C. Harris
Contemporary Instrumental Analysis Kenneth A. Rubinson and Judith F. Rubinson

Introduction

Instrumental Methods of Analysis is the application of instrumental methods to chemical analysis including electrochemical, spectroscopic, spectrophotometric, chromatographic, and thermal analysis. Students learn techniques for: (1) methods development, (2) sample preparation, (3) optimization of operating conditions to obtain accurate, reproducible results, and (4) data analysis.

Upon completing the course the student will be able to:

1. Critically examine a situation requiring experimental information to determine possible ways of obtaining such information (level of analysis, possible interferences, matrix effects, type of analysis).
2. Compare suitability of various instrumental methods and select suitable one or ones for the desired analysis.
3. Obtain suitable information from literature sources for performing an analysis.
4. Prepare samples and operate instruments properly.
5. Recognize possible sources of error in the instrumental analysis; critically evaluate the experimental method and data.
6. Understand mechanisms for obtaining data by instrumental methods; have enough knowledge of the theory and operation of modern analytical instruments and interfaced computer data systems to make rational decisions regarding the procedures to be undertaken.

Attendance

Classes scheduled for this course consist of one lecture hour and six laboratory hours per week. Regular lecture attendance and at least six hours of laboratory work per week are strongly recommended.

Tests

Two tests will be given.... one at midterm and a comprehensive exam at the end of the semester (evaluation week). The tentative dates for these tests are:

Test 1 3/10/03 Monday 9:05 - 10:00

Test 2 5/13/03 Tuesday 12:00 - 1:50

These tests will be based upon materials covered in lectures, and upon the detail of the procedure, theory, and chemistry of analyses performed in the laboratory. The average of the grades earned will amount to about 1/4 to 1/3 of the semester grade (300 out of a total of 1000).

Experiments

Students will work in groups of two (or three). A detailed record of each analytical experiment should be kept by each student in a laboratory notebook. The notebook should include a logical summary of the laboratory work done, the data collected, and any noteworthy observations. In addition a written report on the experiment must be handed in by each group along with their notebooks for evaluation.

All reports will be graded on the basis of (1) description of the instrumentation and method used, standard preparation, and sample dilutions; (2) displayed understanding of the instrument theory; (3) Quality of the acquired data; (4) interpretation of the data, calculations associated with treatment of the data; and (5) discussion of sources of errors introduced during the use of the method, applicability to other related analyses, and statistical analysis of error. Note that reports are prepared by groups, but notebooks are kept by individuals.

The laboratory is flexible in that students may work during some hours other than those regularly scheduled. A set of deadlines is assigned below so that students will be forced to manage their time efficiently and minimize procrastination. Completed experiments may be turned in for evaluation at any time before the deadline.

Each experiment must be turned in by the assigned date so that the next experiment may be begun at the beginning of the following lab period. If an experiment is not completed and the report handed in by the deadline, no credit will be given for that experiment.

Experiment	Deadline	Experiment	Deadline
1	2/14/03	5	4/25/03
2	2/28/03	6	5/9/03
3	3/14/03		
4	4/4/03		

Lab checkout will be on Friday, May 4 (just before Final Exam week) at 8:00. This is our last regular lab day and can potentially be used for last minute lab work.

Grading

Each experiment will be allowed a maximum of 100 points. The following point break down will be used in grading experiments.

A	94 - 100	C	74 - 76
A-	90-93	C-	70-73
B+	87-89	D+	67-69
B	84 - 86	D	64 - 66
B-	80-83	D-	60-63
C+	77 -79	F	0 - 59

The only test in the course will be worth 100 points with 90% or better being an A, 80 - 89.9% a B, etc.

Activity	Maximum Score	Number During Course	Total Points
Test 1	100	1	100
Test 2	200	1	200
Experiments	100	6	600
Homework	20	5	100
		GRAND TOTAL	1000

The total number of course points possible is 1000. Letter grades at the end of the course will be assigned on a percentage basis as follows:

Percent of Maximum Score	Grade	Percent of Maximum Score	Grade
93.1 - 100 %	A	73.1 - 76.9 %	C
90.0 - 93.0 %	A-	70.0 - 73.0 %	C-
87.0 - 89.9 %	B+	67.0 - 69.9 %	D+
83.1 - 86.9 %	B	63.1 - 66.9 %	D
80.0 - 83.0 %	B-	60.0 - 63.0 %	D-
77.0 - 79.9 %	C+	00.0 - 59.9 %	F

Order of Lecture Topics

1	Introduction and Review	Harris Chap 1-4; Rubinson Chap 1-5
2	Fundamentals and Applications of Spectrophotometry	Harris Chap 18- 20
3	Ultraviolet and Visible Spectrophotometry	Rubinson Chap 8
4	Flame Emission, Atomic Absorption, and Atomic Fluorescence	Harris Chap 21 Rubinson Chap 9
5	Infrared Absorption Spectroscopy	Rubinson Chap 10
6	Gas Chromatography	Harris Chap 24 Rubinson Chap 13 and 15
7	Liquid Chromatography	Harris Chap 25 Rubinson Chap 14
8	Nuclear Magnetic Resonance	Rubinson Chap 11

Order of Experiments

Experiment Number	Experiment Title
	Check in, Learn Use of Balance and General Lab Setup
1	Spectrophotometric Measurement of an Equilibrium Constant
2	Measuring Manganese in Steel by Atomic Absorption with Standard Addition and with a Calibration Curve
3	Infrared Spectra of Organic Compounds
4	Detection of Ethanol in Gasoline Using Gas Chromatography
5	Determination of Caffeine in Soft Drinks and Other Beverages Using HPLC
6	Determination of Thermal Properties of Packaging Materials by Differential Scanning Calorimetry
7	NMR Analysis of Organic Compounds (optional in place of DSC lab)

Homework

Five assignments (homework problems) will be given throughout the course of the semester. These assignments will be worth 20 points which will be factored into the final course grade.