

**THE GRADUATE SCHOOL AND UNIVERSITY CENTER  
THE CITY UNIVERSITY OF NEW YORK**

**DOCTORAL CHEMISTRY PROGRAM**

Course Syllabus - Fall 2004

Chemistry 84905  
Analytical Spectroscopy  
Tuesday 4:15 to 7:15PM

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Office Hours -Tues. Before and After class  
Office Analytical Office 4323

This course will concentrate on optical spectroscopy and its use in chemical analysis. The use of micro-spectrophotometry, light microscopy and X-ray spectroscopy techniques may also be introduced. The course will concentrate on the design, performance, and operation of spectrometers as well as the analytical information that can be obtained from them. Proper calibration of the instruments for qualitative and quantitative analysis will be covered. The theoretical basis of the spectra determined will be covered only at a basic level. At the conclusion of the course the successful student will understand the fundamental use and applications of spectroscopy for research and industrial measurements.

The lectures include the description of various instruments including their designs, the theory of operation and the fundamental science on which they are based. The accuracy and precision of measurements as well as error analysis will be introduced. This course is concentrated on electronic and vibrational spectra, although other instrumentation topics will be covered.

This is a lecture only course with a mid term and final exam. Students will be urged to attend the Eastern Analytical Symposium, November 2004, in Sommerset, New Jersey as a field trip. A short library research paper may be required with possible oral presentation in class.

Policies:

1. Attendance Policy is as per the University.
2. Final Grade

Midterm 40%

Final 40%

Research Paper 15% (20% if no oral presentation)

Oral Presentation 5% (If performed)

## Course Outline

<u>Period</u>	<u>Proposed Date</u>	<u>Text Chapter</u>	<u>Topics</u>
1.	8/31	1, Appendix A	Course Goals and Methods. Spectrochemical Information
2.	9/7	1-2	Analytical Instrumentation , Spectrochemical methods
3.	9/14	2-3	Instrument Design, Optical Components of Spectrometers
4.	9/21	3-4	Optical Sources, Transducers, and Measurement Systems
5.	9/28	5-6	Errors, and Calibration of Measurements
6.	10/5	7,8,9	Atomic Spectroscopy, Flames, Plasmas, Arcs, Sparks
7.	10/12	9,10,11	Atomic Spectroscopy Contd. - Arcs, Sparks, Absorption, Fluorescence, X-ray Spectrometry
8.	10/19	All	Midterm
9.	10/26	12	Introduction to Molecular Spectroscopy
10.	11/2	13-15	UV-Visible Absorption, Molecular Luminescence Spectroscopes
11.	11/9	14	Infrared Spectroscopy - Instrumentation and Sampling Methods
XX	11/16	NO Class	Suggested Field Trip to Eastern Analytical Symposium, NJ
12.	11/23	Review	Guest Speaker Optical Rotary Dispersion or Microspectrometry
13.	11/30	Review	Guest Speaker Optical Rotary Dispersion or Microspectrometry
14.	12/7	16	Molecular Scattering Methods, Polarized Light Microscopy
15.	TBA	ALL	Final Exam - Time and Place to be Announced

**PLEASE NOTE: Lecture periods, Dates, and Topics are planned but may be varied due to time restraints and student progress. The Mid Term will likely be in week 8, but this may vary by a week or two either way.**

Reading Assignments : Please read the indicated material prior to the lecture period. This is highly recommended.

Required Textbook:

Spectrochemical Analysis, Ingle, J.D., and Crouch, S.R., Prentice Hall, Upper Saddle River, NJ  
Additional assigned reading from Photocopied handouts.

Bibliography:

Spectrometric Identification of Organic Compounds, Silverstein and Bassler, John Wiley & Sons, N.Y.

Principles of Instrumental Analysis 5<sup>th</sup> ED, Skoog, Holler and Neiman, (1992) Saunders College Publishing. (Harcourt Brace Jovanovich) N.Y.

Organic Structures from Spectra, Steinhell, S. and Kalman, J.R., (1992) John Wiley and Sons, N.Y.

An Introduction to Error Analysis, J. Taylor, (1982) University Science Books, Sausalito California.

The Essential Guide to Analytical Chemistry, G. Schwedt, (1997) John Wiley & Sons, New York.

Modern Infrared Spectroscopy, B. Stuart, B. George and P. McIntyre, (1996) John Wiley & Sons, New York.

Modern Techniques in Applied Molecular Spectroscopy, (1999) Mirabella, F.M., John Wiley and Sons, New York.

Chemical Infrared Fourier Transform Spectroscopy, (1975) Griffiths, P.R., John Wiley and Sons, New York.

Raman Spectroscopy for Chemical Analysis, (2000) McCreery. R.L., Wiley Interscience, New York.

Fourier Transform Infrared Spectroscopy, (1986) Griffiths, P.R., and deHaseth, J.A., Wiley Interscience, New York.

Concepts, Instrumentation and Techniques in Atomic Absorption Spectroscopy, (1988) Beaty, R.D., Perkin Elmer Corp., Norwalk, Connecticut.

Principals and Practice in Spectroscopic Calibrations, (1991) Mark, H., Wiley Interscience, New York.

Internal Reflection Spectroscopy, (1987) Harrick, N.J., Harrick Scientific Corp., Ossining, New York .

Introduction to Microspectrophotometry, (1972) Isaka, H. Ed. Olympus Optical, Tokyo, Japan.

Polarized Light in Optics and Spectroscopy, (1990) Klinger, D.S., Lewis, J.W., and Randall, C.E., Academic Press, New York.

Spectroscopy with Polarized Light, (1986) Michl, J., and Thulstrup, E.W., VHC Publications Inc., New York.

Practical Guide to Infrared Microspectroscopy, (1995) Humecki, H.J. Ed. Marcel Dekker, New York.

Color Atlas and Manual of Microscopy for Criminalists, Chemists, and Conservators, (2004) Petraco. N., and Kubic, T.A., CRC Press, Boca Raton, Florida.

Principles and Practice of X-ray Spectrometric Analysis (2nd ed.), (1975) Bertin, E.P., : Plenum Press, New York.

Identification of Materials: Via Physical Properties Chemical Tests and Microscopy, (1965) Benedetti-Pichler, A.A., Springer-Verlog, New York.