

C612

Spectrochemical Methods of Analysis
Information and Abbreviated Calendar - Spring, 2009

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Text: J. D. Ingle, Jr. and S. R. Crouch, *Spectrochemical Analysis*,
Prentice Hall, NJ, 1988.

January 13	C612 Lectures begin
February 5	Exam #1 on lectures #1 - #7
March 10	Exam #2 on lectures #8 - #15
March 13	Last date to obtain approval of topic for oral report
March 17, 19	NO CLASS - SPRING BREAK
April 14	Exam #3 on lectures #16 - #22
April 16, 21, 23, 28, 30	Oral reports

C612Spectrochemical Methods of Analysis
Detailed Calendar - Spring, 2009

<u>Date</u>	<u>Event or Lecture Number</u>	<u>Lecture Topic</u>
January 13	Lecture #1.	What is spectrochemistry? Nature of a spectrum. Ways of measuring vertical axis on a spectrum.
January 15	Lecture #2	Horizontal axis of spectrum, radiometric units
January 20	Lecture #3	Interferences & errors
January 22	Lecture #4	Signals, noise, precision
January 27	Lecture #5	Detection limits, Image-forming optics
January 29	Lecture #6	Dispersion systems: gratings & prisms
February 3	Lecture #7	Blazed gratings, grating replication, grating mounts
February 5	Exam #1 on Lectures 1 - 7	
February 10	Lecture #8	Fabry-Perot interferometer; interference filters
February 12	Lecture #9	
February 17	Lecture #10	
February 19	Lecture #11	
February 24	Lecture #12	
February 26	Lecture #13	
March 3	Lecture #14	
March 5	Lecture #15	
March 10	Exam #2 on Lectures 8 – 15	
March 12	Lecture #16	
March 13	Last day to obtain approval of topic for Oral Report	
March 17, 19	SPRING BREAK	
March 24	Lecture #17	
March 26	Lecture #18	
March 31	Lecture #19	
April 2	Lecture #20	
April 7	Lecture #21	
April 9	Lecture #22	
April 14	Exam #3 on Lectures 16 - 22	
April 16	Oral reports by J. Felton, A. Graham, J. Hass	
April 21	Oral reports by B. Hildenbrand, M. McCormick, I. Mitra	
April 23	Oral reports by C. Morris, P. Ni, A. Peverly	
April 28	Oral reports by K. Pfeuffer, N. Pierson, N. Sa	
April 30	Oral reports by H. Shi, X. Yan, R. Zakeri	

1. Grading

Grading for C612 will be based on three tests and an oral presentation. The oral presentation will be on a subject to be chosen by you, usually from the attached list. This report is intended to cover a *practical or instrumental* aspect of spectroscopy or spectrochemical analysis and will provide students a measure of control over the subject matter to be covered in C612.

The oral presentation will be given during one of the last scheduled class periods and should be of exactly 20 minutes duration. There will be an additional 5 minutes allotted for questions but you should not fill them up with lecture material. It is hoped that the requirement of having you prepare and deliver an oral report will not only help you in future scientific communication, but also will broaden the scope of C612 and improve information transmission to your colleagues.

The oral reports will be assigned 25 points, and all written exams will have equal weight (25% each) in determining your final grade. Exams this year will be held on the following dates:

Exam I	February 5, 2009
Exam II	March 10, 2009
Exam III	April 14, 2009

Exam scores and final grades will be posted on OnCourse. At the end of the semester you also can pick up the detailed grading and comment sheet from your oral report (see below) in room A150A.

2. Oral Report

Note that the Oral Report must be on an approved topic. The deadline for having your topic approved is given in both the abbreviated and detailed calendars in the front of these sheets and is early enough to give you ample time for preparation of an excellent lecture.

Because the effectiveness of any lecture is based on both its delivery and content, your grade will be similarly constructed. Delivery includes not only your lecturing style but also the organization of the talk, the quality of your visual aids, and your timing; these components will decide 40% of the grade for your presentation. The remaining 60% will be derived from its content, which includes the scope and appropriateness of the topic and your thoroughness in treating it.

Although it is not required, past classes have found it useful to have available copies of the PowerPoint material that is used in the oral reports. If you wish to distribute such copies to be used with your report, we can arrange to have them made for you. However, we will need to have the originals in hand at least a week before your lecture to do so. The originals should be given to the secretary in A150. No matter whether or not you intend to distribute material to the class, you are required to submit a copy of your PowerPoint presentation to the instructor at the time of your lecture. This requirement will be reflected in the “presentation” part of your grade.

The list of topics appended to these sheets is not meant to be exhaustive or comprehensive. Feel free to suggest others. Also, it is permitted and even desirable to have your topic overlap with your research, if it is possible. In that way, your level of interest in and authority over the subject will be greater. However, do not dwell on applications of spectrochemical methods or on their coupling with other techniques (e.g. in their application to chromatographic detection or to the study of electrode processes). The focus of your subject must be spectrochemical analysis. Because of overlap with C613, coverage of mass spectrometry is not acceptable, although other “particle” methods (e.g. electron spectroscopy) are fine.

3. **Lecture Notes**

For your convenience, a set of lecture notes and supplementary material is available at the bookstore and can be purchased for a modest fee. This material will help you keep pace in class and will serve as a valuable aid in studying for exams. From time to time, additional material will be distributed in class.

4. **Academic Misconduct**

It should go without saying that cheating, plagiarism, and other forms of academic misconduct are unacceptable and intolerable. The attached document on this subject has been approved by the IU Board of Trustees and the Bloomington Campus Faculty Council. It has been taken directly from the IU Code of Student Rights, Responsibilities, and Conduct

5. **Journals of Interest**

Analyst

Analytical and Bioanalytical Chemistry

Analytica Chimica Acta

Analytical Letters

Analytical Chemistry

Applied Optics (Current issues in Optometry Library; prev. years in Chem. library)

Applied Spectroscopy

Applied Spectroscopy Reviews

Chemical Instrumentation

ICP Information Newsletter

J. American Society for Mass Spectrometry

J. Analytical Atomic Spectrometry

J. Optical Society of America

Journal of Quantitative Spectroscopy and Radiative Transfer (Swain Hall)

Journal of the Optical Society of America

Journal of Scientific Instruments (British)

Metallomics

Optics and Spectroscopy (Translated from Russian)

Optics Letters

Review of Scientific Instruments

Spectroscopy Letters

Spectrochimica Acta, Parts A and B

Trends in Analytical Chemistry

Talanta

Vibrational Spectroscopy

C612

Spectrochemical Methods of Analysis

POSSIBLE TOPICS FOR ORAL REPORT

1. PM Tubes (operation, practical limits)
2. Signal Collection Optics
3. Optical coatings - how and why
4. Interferometer Designs (Mach-Zander, etc.) and their application
5. Use of Coaxial Cable
6. Novel ion sources in mass spectrometry
7. Photographic vs. Photoelectric Readout
8. Solid Samples in IR Spectrometry
9. Methods for elemental analysis of solid samples
10. Sampling (Data Taking) Rates
11. Two-dimensional array detectors
12. Plasma source mass spectrometry
13. Instrumental tradeoffs (time vs. accuracy, etc.)
14. Glow-discharge source configurations
15. Slit width selection (resolution vs. optical speed)
16. Using Optical Benches properly
17. A Comparison - Grafting vs. Prism Spectrographs
18. A Comparison - Reflecting vs. Refracting Optics (Lens vs. Mirror)
19. Unusual Prisms and Their Application
20. Calibrating a Spectrograph wavelength scale
21. The consequences of Vignetting
22. Stray Light in Spectrographs: its effect and elimination
23. Picosecond Spectroscopic Methods (Detection)
24. Elimination of Noise Pickup from External Devices
25. DC Plasma Sources
26. Laser diodes and their application to spectrochemical analysis
27. Zeeman Atomic Absorption
28. Coherent Optical Transients
29. "Fast" (nanosecond) Light Sources
30. Impedance matching and its effect on Signals
31. Hyphenated techniques
32. Raman Microprobe Spectroscopy

33. Reaction-rate Methods of Analysis
34. Ultra-Fast (picosecond) light Sources
35. Laser-induced breakdown spectroscopy
36. Microscopy as an Analytical and Spectroscopic Tool
37. High frequency (RF or microwave) discharges and their use in spectrochemistry
38. High power continuum sources (Xe arc, etc.)
39. Tunable lasers - state of the art
40. Lasers in spectrochemical analysis
41. Auger spectroscopy
42. ESCA or other methods of electron spectroscopy
43. Activation analysis
44. Energy-dispersive X-ray spectrometry
45. Generalized standard additions method
46. Near-IR Raman spectrometry
47. Quantitative Raman spectrometry
48. Atmospheric pressure microwave discharges
49. Detection in laser spectroscopy
50. Photoacoustic spectroscopy
51. Thermal wave imaging spectroscopy
52. New or unusual methods for nebulizing sample solutions
53. Echelle gratings and their use
54. XAFS (X-ray absorption fine structure)
55. Microsampling in FTIR
56. Resonance ionization spectroscopy
57. Applications of synchrotron radiation
58. Dual-wavelength spectrometry
59. Derivative spectrometry
60. Ultra-trace (single atom or molecule?) spectroscopic detection
61. Choosing a grating
62. Design and construction of holographic gratings
63. Matrix isolation spectroscopy
64. The Shpolskii effect
65. Robotics in spectrochemistry
66. Oxygen plasma ashing or organic-based samples
67. Solid-sample NMR
68. Use of Ellipsometry for surface characterization
69. Uses of the Atomic Faraday effect
70. Coupling flow-injection analysis to spectroscopy systems

71. Imaging solids by NMR
72. Positron emission tomography
73. Integrated optics for spectroscopy
74. Kerr cells, Pockels cells, Bragg cells; electro-optics and acousto-optics and their use in spectrochemical analysis
75. Near-IR reflectance analysis
76. Fresnel lenses
77. Fiber optics in spectroscopic instrumentation
78. Ultra-high-resolution NMR
79. Mass-spectrometry/mass spectrometry (tandem MS)
80. Secondary-ion mass spectrometry
81. Coherent forward scattering spectrometry
82. Atom trapping
83. Optical levitation
84. Optical computing
85. Phase-resolved fluorescence spectroscopy
86. Phase conjugate reflection
87. Performance comparison of different mass-spectrometer configurations
88. Confocal microscopy
89. Phase-contrast microscopy
90. Total-reflection X-ray Fluorescence spectrometry
91. Sub-wavelength optical microscopy
92. Near-field scanning optical microscopy
93. Spectrometric measurement of extremely small samples
94. Tomographic methods in spectrometry
95. Isotope-dilution methods in nuclear and mass spectrometry
96. Application of chemometric techniques to spectrochemical analysis
97. Macromolecule analysis by mass spectrometry
98. Cavity ring-down spectroscopy
99. Radio-frequency glow discharges
100. Ionization methods in mass spectrometry
101. Surface plasmon resonance
102. Analytical applications of quantum dots
103. Analytical applications of molecular wires
104. High-voltage sparks and their spectrochemical uses
105. Photographic emulsions as detection systems
106. Multichannel detection in mass spectrometry

IU Code of Student Rights, Responsibilities, and Conduct

Part 3: Section A Academic Misconduct

The university may discipline a student for academic misconduct, which is defined as any activity which tends to undermine the academic integrity of the institution. Academic misconduct includes, but is not limited to, the following:

1. Cheating

A student must not use or attempt to use unauthorized assistance, materials, information, or study aids in any academic exercise, including, but not limited to, the following:

- a. A student must not use external assistance on any "in-class" or "take-home" examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, and calculators.
- b. A student must not use another person as a substitute in the taking of an examination or quiz.
- c. A student must not steal examinations or other course materials.
- d. A student must not allow others to conduct research or to prepare work for him or her without advance authorization from the instructor to whom the work is being submitted. Under this prohibition, a student must not make any unauthorized use of materials obtained from commercial term paper companies or from files of papers prepared by other persons.
- e. A student must not collaborate with other persons on a particular project and submit a copy of a written report which is represented explicitly or implicitly as the student's individual work.
- f. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on field work.
- g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor to whom the work is being submitted.
- h. A student must not alter a grade or score in any way.

2. Fabrication

A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citations to the sources of information.

3. Plagiarism

A student must not adopt or reproduce ideas, words, or statements of another person without appropriate acknowledgment. A student must give credit to the originality of others and acknowledge an indebtedness whenever he or she does any of the following:

- a. Quotes another person's actual words, either oral or written;
- b. Paraphrases another person's words, either oral or written;
- c. Uses another person's idea, opinion, or theory; or
- d. Borrows facts, statistics, or other illustrative material, unless the information is common knowledge.

4. Interference

- a. A student must not steal, change, destroy, or impede another student's work. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.
- b. A student must not give or offer a bribe, promise favors, or make threats with the intention of affecting a grade or the evaluation of academic performance.

5. Violation of Course Rules

A student must not violate course rules as contained in a course syllabus which are rationally related to the content of the course or to the enhancement of the learning process in the course.

6. Facilitating Academic Dishonesty

A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct.