

Chemistry 620
Analytical Spectroscopy
Syllabus
Spring 2008

Course Description and Objectives:

Chemistry 620 is a graduate-level survey of optical spectrochemical analysis. The focus of the course is the question "What can be determined about the nature and properties of matter via its interactions with photons?" The course considers the elements of optical measurements from the standpoint of light/matter interactions. The course manages this broad topic in two stages: the first covers the basic principles that describe the operation of spectrometer components; the second uses four papers chosen by the class from the literature to illustrate the details of modern measurements. The course is intended for graduate students and well-prepared undergraduates in chemistry and biochemistry or closely allied fields. This course presumes basic knowledge of physics, electronics, physical chemistry and instrumental analysis.

The objectives of Chem. 620 are that the student be able to 1) describe the basic scientific principles underlying optical measurements; 2) describe the operation of the instrument components required to make optical measurements; 3) compute the amount of light generated, passed or detected by the components discussed; 4) evaluate results of measurements in terms of common interferences and noise sources; 5) critique (orally and in writing) papers from the literature that describe measurements utilizing the elements covered in the course.

Course Instruction:

Course Instructor: Prof. S. L. Neal
Office: 107 LDL Telephone: 831-0719
E-Mail: sneal@udel.edu
Office Hours: 1:30-2:30W; 10:30-11:30F, or by appointment

Tentative Schedule for Lectures:

All lectures are scheduled for 3:30-4:45 pm TR in BRL116

<u>Week of</u>	<u>Topics to be Covered</u>	<u>Reading Assignment</u>
02/11/08	Lasers & Photon Detectors	<i>Chi</i> , Sect 3, pp 5-10
02/18/08	Light Propagation in Dielectrics	<i>Chi</i> , Sect 4, pp 12-16
02/25/08	Light Propagation at Interfaces, Polarizers	<i>Chi</i> , Sect 5-6, pp TBA
03/03/08	Imaging	<i>Chi</i> , Sect 7, pp TBA
03/10/08	Interference & Diffraction	<i>Chi</i> , Sect 8, pp TBA
03/17/08	Fourier Transform Spectroscopy	<i>Chi</i> , Sect 9, pp TBA
03/24/08	Noise	<i>Chi</i> , Sect 10, pp TBA
03/31/08	<i>Spring Break</i>	
04/07/08	Midterm	
04/14/08	Paper I	TBA
04/21/08	Paper II	TBA
04/28/08	Paper III	TBA
05/05/08	Paper IV	TBA
05/12/08	Student Presentations	
05/19/08	Student Presentations , Research Papers due	

Outlines for class discussions will be available on the course website before noon on the day of the lecture. The lecture schedule on the course website will be updated regularly to reflect course progress and changes in topic coverage.

Required Materials:

Many students find comfort in the familiarity of a textbook; sadly none that covers the relevant material has been released in recent years. Consequently, the instructors of this course have written a monograph that defines the scope and context of the course:

Wirth, M.J and Neal, S.L., *Chi.*, 2008.

Additional resources:

Since no text adequately covers the course content, the successful student will use the discussions in *Chi* to direct and limit their reading in other texts. Several excellent books cover specific aspects of the course content. The following are on reserve in the Chemistry Library:

Ingle, J.D.; Crouch, S.R., *Spectrochemical Analysis*, Englewood Cliffs: Prentice-Hall, 1988

James, J. F., *The design of optical spectrometers*, London, Chapman & Hall, 1969.

Hecht, E., *Optics*, 3rd ed. Reading, Mass: Addison-Wesley, 1998.

Moore, J.H, Davis, C.C, Coplan, M.A., *Building Scientific Apparatus*, 2nd ed. Reading, Mass: Addison-Wesley, 1989.

Marshall, A. and Verdun, F., *Fourier Transforms in NMR, Optical & Mass Spectroscopy*. Amsterdam: Elsevier, 1990.

Students who feel they must have a textbook will find many of the topics discussed in Ingle & Crouch, but most modern aspects of the course content are not covered there. Some students benefit from having an undergraduate level instrumentation text handy for review. For example:

D.A. Skoog, F.J. Holler and S.R. Crouch, *Principles of Instrumental Analysis*, 6th Ed., Thompson Brooks/Cole, 2007.

Grading:

Students will be graded based on their performance on homework exercises, a midterm, research paper and presentation. The total number of points the student earns will determine the grade each student receives. The distribution of points will be:

Exercise		Points Available
Midterm		30
Homework Portfolio for Part 1	due 4/10	10
Homework Portfolio for Part II	due 5/13	10
Research Presentation	TBA	20
Research Paper	due 5/20	30
TOTAL		100
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Homework problems covering the reading will be assigned on Thursday of each week. The student should use the relevant material in Chi and the reserve texts to *attempt* the homework and be prepared to discuss the corresponding concepts during the Tuesday class period. Preliminary homework solutions will be turned in on Thursday and quickly returned to the students so that s/he may submit a portfolio of corrected homework papers for credit on April 10th. The first midterm exam will consist of a series of problems (including calculations) and essay questions often based on hypothetical situations.

In the second part of the course, the reading assignments will be selected from the literature. On Tuesday, each student will turn in a short (< 1 page) summary of the paper under discussion, including concise statements of the goals and results of the work. On Thursday student will turn in the assigned problem set. Corrected homework answers will be collected into a portfolio and turned in for credit on May 13th.

The final assignment consists of a paper and oral presentation reviewing an emerging optical method or novel application of a spectroscopic measurement selected by the student with the advice (if needed) and consent of the instructor. This paper should be at least 12 pages, but no more than 18 pages long (double-spaced), not including figures and references. Detailed instructions are provided in a separate document.

Letter grades will be assigned based on the total number of points earned by the student using a scale close to the following:

Percentage	Grade	Percentage	Grade
92	A	72	C
88	A-	68	C-
85	B+	65	D+
82	B	62	D
78	B-	55	F
75	C+		

Policies:

Instructor Absences:

The instructor may be absent a few times during the semester due to work related travel. In most cases a substitute instructor will be present; if necessary, notice of class cancellation will be made by email and on the Announcements page of the course website.

Academic Honesty:

You are encouraged to be familiar with the University's Policy of Academic Honesty found in the UD Student Guide to University Policies, which can be found at this [link](#) to the Catalog. The policies delineated there apply to this course. While the content of this course can (and should!) be discussed with others, material submitted for grading must be done independently. It is also critical that material copied from print and electronic resources be clearly attributed. Submitting

work for grading asserts your awareness of the academic honesty policy and affirms your adherence to it.

Attendance and Excused Absences Policy:

Though attendance is not taken at lecture, you are expected to attend all scheduled lectures and laboratories. Some topics may be discussed in class yet not be duplicated in the class materials on the website, but each student is responsible for all of the class discussion, regardless of attendance. The class policy on absences follows the University policy, which can be found at this [link](#) to the Catalog. Any absences from the midterm should be announced, if possible, in advance of the exam, and the student missing the exam must document the legitimacy of their absences through the Dean's office in order to be offered a make-up exam. The make-up exam will not be identical to the exam given during the scheduled period.

Special Accommodations:

Students requesting special accommodations in Chem 620 must already be registered with UD's ADA Center or Academic Services Center, as appropriate. Those students should contact the course instructor well in advance of any course activity to arrange for special accommodations that follow the terms of the arrangements set by the Center staff.

E-Mail Policy:

Important notices and answers to questions will be sent to the class distribution list to provide the fastest dissemination of information. The registrar will add your campus e-mail account to the class distribution list, so plan to activate your campus e-mail account quickly and check it often.

Every effort will be made to respond promptly to e-mailed questions or concerns from students. Be aware that because University antivirus software and SPAM filters may trap and remove mail - especially external mail - under some circumstances, only e-mail originating from UD accounts will receive responses. UD virus and spam filters currently remove "zip" and closely related, executable file attachments whether or not they show signs of infection, so information sent in the form of "zip" files or their executable relatives cannot be received.

Cell Phone Policy:

Placing and receiving phone calls in class is disruptive and discourteous to your fellow students as well as the instructor. You are expected to turn your cell phone off and stow it during lectures and course help sessions. Accessing a cell phone during any Chem 620 exam may result in the immediate expulsion of the student from the exam.

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Access updated versions of this document via the [Course Home Pages](#) link on the Chem. & Biochem. website: www.udel.edu/chem/course.htm or at <http://www.udel.edu/chem/sneal/sntch/CHEM620/c620.home.htm>

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