MOLECULAR SPECTROSCOPY

Chemistry 632 Overview and Schedule ---- Fall 2015

Instructor	Dr. William Simpson (REIC 186, IARC 335, 474-7235, 474-2436, wrsimpson@alaska.edu)
Office Hours	Th 2:00P–3:00P, Friday 1:00P–2:30P, and any other time by appointment
Lecture	MWF 11:45A–12:45P, REIC 165
Text	"Molecular Spectroscopy", J. Michael Hollas, Wiley
Optional Text	"Laser Spectroscopy", Wolfgang Demtröder, Springer Verlag, Germany
Supplements	Handouts in class and assignments in current literature
Credits	3 credits

Course Description (from Catalog):

Application of quantum mechanics to molecular bonding and spectroscopy. Topics include: applications of lasers to probe chemical reactivity, photochemistry and the detection of trace compounds in mixtures. Variable content. May be repeated for credit. Prerequisites: CHEM F332. (3+0)

Course Overview:

Molecular spectroscopy studies the interaction of light and matter and probes the matter and its environment. It is the basis of molecular structure determination, many microscope techniques, and most remote sensing techniques. This graduate-level class will be techniques oriented and cover IR, visible, UV, and emission (fluorescence) spectroscopy. We will also discuss most current laser spectroscopic techniques. We'll also discuss X-ray, photoelectron and other high-energy spectroscopic methods.

Course Goals

The class will teach students what information molecular spectroscopy provides to scientists as well as how to carry out molecular spectroscopy experiments. Successful student learning outcomes will be that a student will know which spectroscopic technique will provide the information that they want to know, how to record this spectrum (experimentally), and how to interpret the results.

Course Structure

The class will consist primarily of lectures by the professor. These lectures and reading in the text will prepare you to complete the homework problem sets. Much of your learning of molecular spectroscopy will occur during your solving of the problem sets. I would encourage you to work with others to complete these problem sets but you must write up your own answers independently. I will assign students to read recent papers in the literature and report to the class on their paper. There will also be two examinations, one at midterm, and one at the course's completion.

Exams:

The midterm and final exams will be given during class, and will take the given period (1.5 hours for midterm, 2 hours for final). You are permitted to use a calculator, a unit sheet (distributed with the exams), and a half sheet of paper (8.5"x5.5") containing only formulas (for the final exam, you can use a full sheet of paper). You should continually prepare this sheet as you study the material. Don't copy your friend's sheet. Preparing and organizing material is essential. I will look at the sheet during the exam and may collect the sheet. Chemistry Department regulations require that any student caught cheating on graded work will be assigned a course grade of F. Course drop forms will not be signed in these cases. Problem set and exam solutions will be **posted on the web in the Blackboard system**.

Make up exams:

Make-up exams will be allowed if you have a good reason. If you anticipate an absence (work commitments, intercollegiate sports), talk to me **before** the exam to make arrangements. If the absence is unexpected (illness, family or personal difficulties), *talk with me at the earliest possible opportunity*.

Support Services:

Disability Services provides academic accommodations to enrolled students who are identified as being eligible for these services. If you believe you are eligible, please visit http://www.uaf.edu/disability/ on the web, via email: uaf-disabilityservices@alaska.edu, by phone at (907) 474-5655, or by TTY at (907) 474-1827. They will work with you to determine appropriate accommodations. To assure that these accommodations can be applied fairly, please complete this process and discuss it with me in the first two weeks of class.

Grading:

The grading for this class is shown in the table below

Homework problem sets	45%
Presentations of current literature	10%
Midterm examination	20%
Final examination	25%

Grades will be assigned on the scale A=90-100%, B=80-89%, C=70-79%, D=60-69%. We will not be using +/- grading in this course.

Important Dates:

Last day for 100% refund of tuition and fees..... Friday, 18 Sep
Last day for student-initiated and faculty-initiated drops ..... Friday, 18 Sep
Last day for withdrawals (W appears on academic record) .....Friday, 30 Oct
Thanksgiving break (no classes).....Thur-Fri. 26-27 Nov
Last day of instruction .....Monday, 14 Dec
Final Examination..... 10:15 a.m.-12:15 p.m.Friday, 18 Dec

Topic schedule:

Week	Chapter	Topic	Dates	Events / Notes
0	Units	Introduction	4 Sep	
1	1	Background review of quantum mechanics	9,11 Sep	7 Sep: Holiday
2	2	Interaction of light and matter	14,16,18 Sep	14 Sep: Set0 due
3	3	Instrumental considerations	21, 23,25 Sep	25 Sep: Set1 due
4	4,5	Symmetry review and rotational spectroscopy	28, 30 Sep, 2 Oct	
5	5,6	Ro-vibrational spectroscopy of diatomics	5, 7, 9 Oct	9 Oct: Set2 due
6	6	Raman and vibrational spectra of polyatomics	12, 14, 16 Oct	
7	7	Basic electronic spectroscopy	19, 21, 23 Oct	23 Oct: Set 3 due
8	7	Electronic spectra	26, 28, 30 Oct	30 Oct: Midterm Exam
9	7, handouts	Fluorescence and Phosphorescence	2, 4, 6, Nov	
10	8	Photoelectron and X-Ray spectroscopies	9, 11, 13 Nov	13 Nov: Set 4 due
11	9, handouts	Frequency domain laser techniques	16, 18, 20 Nov	
12	9, handouts	Time domain laser techniques	23, 25 Nov	27 Nov: T-day holiday
13	9, handouts	Remote sensing and ultrasensitive spectroscopy	30 Nov, 2, 4 Dec	4 Dec: Set 5 due
14	literature	**Spectroscopy Symposium Week**	7, 9, 11 Dec	
15		Review, Final Exam	14, 18 Dec	10:15-12:15 18 Dec: Final

Class web page:

Because some of the material provided on the webpage is copyrighted, we will put the webpage on the blackboard system, which can be accessed at:

http://classes.uaf.edu/

See this page for generally useful information on the class. I'll be posting announcements about the class and also emailing them to you, so be sure to check the class blackboard site for information.