

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
Molecular Spectroscopy 59-341
Winter Term 2007

LECTURES: Tuesday & Thursday 2:30am – 3:50 p.m. Room: ER2139

PROFESSOR: Dr. Jichang Wang (Office: EH 393, ext. 3540);
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Website: <http://mutuslab.cs.uwindsor.ca/Wang/59-341>

Office hours: My office hours are quite flexible and will be adjusted around your schedule of classes and labs. Walk-ins are welcome, or email me to arrange the consultation time. Email is effective for straight-forward questions.

Textbook: **There is no textbook for this class and recommended readings are listed on the website.**

Course Outline:

The purpose of this course is to provide an advanced level undergraduate student in Chemistry or Physics with a general overview of molecular spectroscopy. Specifically, the underlying principles of spectroscopy are examined using quantum mechanics, the interaction of light and matter, and group theory as starting points. The main focus of this course is the various forms of optical spectroscopy, including rotational, vibrational and electronic spectroscopy, as well as a brief look at photoelectron spectroscopy and lasers. The course finishes with an introduction to radiofrequency spectroscopy techniques, including nuclear magnetic resonance and electron spin resonance.

Tentatively, lectures will cover the following topics:

Interaction of Electromagnetic Radiation with Matter

- A. Electromagnetic Radiation
- B. Electromagnetic Spectrum
- C. Absorption and Emission of Radiation
- D. Line Intensity, Line Width, Broadening & the Doppler Effect

Review of Quantum Mechanics

- A. Development and evolution of quantum theory
- B. Wave-particle duality
- C. Schroedinger equation
- D. Wavefunctions: The Born interpretation and their physical meaning
- E. Heisenberg Uncertainty Principle
- F. Applying the Schroedinger Equation

Experimental Methods: General Features

- A. Absorption experiments
- B. Dispersing elements: Prisms and Gratings
- C. Fourier transform spectroscopy (lower frequencies)
- D. Interferometers (higher frequencies)
- E. Summary of Absorption Experiments over the EM Spectrum
- F. Scattering (Raman techniques)
- G. Other experimental techniques (ATR, AAS, ICP-AES, photolysis)
- H. Magnetic resonance techniques

Molecular Symmetry

- A. Symmetry elements
- B. Point Groups
- C. Character Tables
- D. Consequences of Symmetry: Dipole Moments and Chirality
- E. Molecular orbitals and symmetry
- F. Selection rules and symmetry

Rotational Spectroscopy

- A. Moments of Inertia for differently shaped molecules
- B. Rotational IR, Millimetre Wave and Microwave Spectra
- C. Rotational Raman Spectroscopy
- D. Structure Determination from Rotational Spectroscopy

Vibrational Spectroscopy

- A. Molecular Vibrations
- B. Diatomic molecules
- C. Polyatomic molecules
- D. Applications

Electronic Spectroscopy

- A. Atomic Spectroscopy
- B. Diatomic Molecules
- C. Polyatomic Molecules

Photoelectron Spectroscopy, Related Techniques and Lasers

- A. Photoelectron Spectroscopy
- B. Auger Electron and XPS
- C. X-ray fluorescence spectroscopy
- D. EXAFS
- E. Introduction to Lasers

Problem sets related to topics covered in the lecture will be provided once a week. Attendance is **VERY IMPORTANT** to be successful in this course - students who do not attend lectures generally score very low on exams and assignments. You must keep up with the material as the semester progresses. **Course evaluation will be conducted at the beginning of the last lecture (April 12, 2007).**

This course does not have a lab section.

Assignments

There are two take-home assignments in this course.

Midterm Examination

There is one midterm exams in this course. The only valid excuse for missing an exam is a documented medical emergency. In such a case the value of the final exam will be increased. A missed exam without medical documentation will result in a mark of zero. Only examinations written in non-erasable ink will be considered for a grade appeal. All grade appeals must be made either within one week after the examination is returned to the class, or by a date designated by the professor. Plagiarism is defined in paragraph 2.5.12 in the University Calendar.

Midterm

Tuesday, February 22, 2007

Room: ER 2139

Final Examination

The final exam is cumulative. A student may inspect his/her own corrected final examination. All posted final grades are unofficial, and non-negotiable. Students who wish a formal appeal of their final examination grade as described in Paragraph 2.7.4 of the Calendar may complete the appropriate paperwork at the registrar's office. In general, successful appeals will be based solely on academic merit. Grade appeals to satisfy admission requirements or other program prerequisites will be *rejected*.

Final Exam

Tuesday, April 26, 2007

Room: TBA

Grading: The overall grade will be determined using home assignments, one Mid-Term Test (70 minutes), the laboratory and a 3-hour comprehensive final exam with the following formula being used:

Midterm	30%
Assignments	20%
Final Examination	50%

The accumulated numerical mark (%) will be converted into a letter grade based on the following equivalents which lists the minimum numerical marks and their corresponding letter grades:

100 – 93	A+	92.9 – 87	A	86.9 – 80	A-
79.9 – 76	B+	75.9 – 73	B	72.9 – 70	B-
69.9 – 66	C+	65.9 – 63	C	62.9 – 60	C-
59.9 – 56	D+	55.9 – 53	D	52.9 – 50	D-
49.9 – 36	F	35.9 – 0	F-		

The Department of Chemistry and Biochemistry does not require GRE scores for Spring and Fall 2021 graduate applications. Welcome to the Department of Chemistry and Biochemistry at UMBC! Find resources by checking out the pages below. —€ Past Events Next —€
¶ Page 1 of 1. There is nothing to show at this time. @UMBCChemistry. My Tweets. Summer Undergraduate Research Opportunities. Mellon Foundation supported Baltimore SCIART: A Summer Research Experience for Undergraduate Students at the Interface between Science and Art at UMBC. Polymer Chemistry and Soft Nanomaterials. J. Daniel Gezelter. Molecular Dynamics of Complex Interfaces.Â Bioorganic Chemistry and Biochemistry. Jeffrey W. Peng. Biophysics NMR Methods and Biomolecular Dynamics. Biochemistry Freshmen Receive Honors College Scholarships. Chemical Physics Major Research Featured. Chemistry Professors Receive NSF Award to Explore Lower-Energy Light. Chemistry Graduate Wins National Portz Scholarship for the Second Year in a Row. Events. Thu.Â Advancing Society Through the Continuous Pursuit of Educational Excellence and Cutting-Edge Research in Chemistry. Department of Chemistry 322 Coulter Hall, University, MS 38677 662-915-7301 chemistry@olemiss.edu.