

Chemistry 532
Advanced Physical Chemistry II
Spring 2023 Course Syllabus

Instructor:

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401-874-5516

Office hours:

Any time (email me to arrange in advance)

Lecture:

TR 9:30-10:45 am, Beaupre 215

Required texts:

Jeanne L. McHale, *Molecular Spectroscopy* (2nd edition)
Daniel C. Harris & Michael D. Bertolucci, *Symmetry and Spectroscopy* (New Edition)

Other recommended texts:

Donald A. McQuarrie, *Quantum Chemistry*
J. Michael Hollas, *Modern Spectroscopy*
F. A. Cotton, *Chemical Applications of Group Theory*
Russell S. Drago, *Physical Methods for Chemists*

Prerequisites:

CHM 531 or permission of instructor

Overview:

This course aims to provide a comprehensive introduction to time-dependent phenomena and molecular spectroscopy, with a focus on vibrational and electronic spectroscopy. We will also cover several advanced topics, including nonlinear and time-resolved spectroscopies.

Grades:

| | |
|------------------------------------|-----------------------|
| a. Homework (lowest grade dropped) | 100 pts |
| b. Two 75-minute exams | 200 pts |
| c. Final exam | 200 pts |
| | Total: 500 pts |

Please note that changes to the syllabus may be made to account for unforeseen circumstances (weather, etc.), but students will be notified in advance of any changes.

Exams:

All exams will be held in class and will be open book and open notes. If a student cannot take an exam because of a medical or other emergency, documentation must be provided before a make-up exam will be given.

Homework:

New problem sets will be uploaded most weeks, and you will always have at least one full week to complete each assignment. Homework should ideally be submitted in class, but submissions will be accepted until 5pm on the due date. Late submissions are NOT accepted. Note that the lowest grade is dropped. You are strongly encouraged to work on the problem sets together, but remember that you will need to be able to solve similar problems independently during exams. If you would like additional practice, the primary textbooks have many excellent problems at the end of each chapter.

Readings:

All readings are listed in the course outline below. “MS” refers to *Molecular Spectroscopy*, while “S&S” refers to *Symmetry and Spectroscopy*. In some cases, the readings will be supplemented with handouts, which will be uploaded to Brightspace. MS Chapter 1 and S&S Chapter 2 provide general reviews of quantum mechanics and will NOT be covered in class. You are encouraged to read these independently and/or revisit Chapters 1-8 of McQuarrie’s *Quantum Chemistry* (QC) for a refresher before this class begins.

The CHM 532 Brightspace page:

All supplementary notes, problem sets, problem set solutions, and exam solutions will be posted on the course Brightspace page.

Extra help:

You may find that you need additional in-person assistance to master the course material. I will be available for office hours throughout the week. Please stop by my office or email me to set up an appointment.

Disability, Access, and Inclusion Services for Students:

Your access in this course is important. Please send me your Disability, Access, and Inclusion (DAI) accommodation letter early in the semester so that we have adequate time to discuss and arrange your approved academic accommodations. If you have not yet established services through DAI, please contact them to engage in a confidential conversation about the process for requesting reasonable accommodations in the classroom. DAI can be reached by calling: 401-874-2098, visiting <http://web.uri.edu/disability>, or emailing: dai@etal.uri.edu.

Anti-Bias Statement:

We respect the rights and dignity of each individual and group. We reject prejudice and intolerance, and we work to understand differences. We believe that equity and inclusion are critical components for campus community members to thrive. If you are a target or a witness of a bias incident, you are encouraged to submit a report to the URI Bias Response Team at www.uri.edu/brt. There you will also find people and resources to help.

COVID/Viral Illness Precautions Statement:

The University is committed to delivering its educational mission while protecting the health and safety of our community. As members of the URI community, students are required to comply with standards of conduct and take precautions to keep themselves and others safe.

- Masks are required in all classrooms, laboratories, and spaces where direct academic instruction and research are taking place, unless the instructor or staff member expressly waives that requirement.
- Students who are experiencing symptoms of viral illness should NOT go to class/work. Those who test positive for COVID-19 should follow the [isolation guidelines](#) from the Rhode Island Department of Health and CDC.

If you are unable to attend class, please notify me prior to the start of class at 401-874-5516 or dugan@uri.edu.

Course schedule:

| Date | Material | Readings |
|---------------|---|----------------------------------|
| Before class | Review of quantum mechanics, Fourier series/transforms, and probability (lecture videos available online) | MS1, S&S2, QC1-8 QC-B/C, handout |
| 01/24 – 01/31 | Electromagnetic radiation | MS2, Hollas 2 |
| 01/31 – 02/07 | Electric and magnetic properties of molecules | MS3 |
| 02/09 – 02/16 | Time-dependent perturbation theory of spectroscopy | MS4 |
| 02/21 | The time-dependent approach to spectroscopy | MS5 |
| 02/23 | EXAM 1 (MS2-4) | --- |
| 02/28 | The time-dependent approach to spectroscopy, cont. | MS5 |
| 03/02 – 03/07 | Experimental considerations | MS6, Hollas 3 |
| 03/07 – 03/21 | Molecular symmetry and group theory | S&S1, Hollas 4 |
| 03/23 – 03/30 | Vibrational spectroscopy | MS9-10, S&S3 |
| 04/04 | EXAM 2 (MS6, MS9-10, S&S1-3) | --- |
| 04/06 – 04/18 | Electronic spectroscopy | MS11, S&S5 |
| 04/20 – 04/27 | Time resolved spectroscopy | MS14 |
| 05/09 | FINAL EXAM (comprehensive), 11:30 am | --- |