

Syllabus (Fall 2016)  
**Chemistry 762**  
**Topics in Physical Chemistry: Laser Spectroscopy**

The policies and regulations contained in this syllabus are subject to change at any point. Such changes will be announced in class and/or posted on the course website. The syllabus has been compiled to be as complete as possible but is by no means a binding document.

### General Info

Instructor: Prof. **Jörg C. Woehl**  
Office: Chemistry Building, Room 343 (CHM 343)  
Office hours: Open door and by appointment  
Email: [woehl@uwm.edu](mailto:woehl@uwm.edu)  
Phone: 414-229-5223

Class Meeting Times: Tuesday and Thursday, 3:00-4:15 pm  
Class Location: Kenwood IRC, Room 1180 (KEN 1180)  
First Day of Class: Tuesday, September 6  
Last Day of Class: Tuesday, December 13  
Midterm (take-home): Thursday, October 20; due Thursday, October 27  
Final Exam (take-home): Tuesday, December 13; due Tuesday December 20

### Course Objectives

This course will focus on classical and quantum-mechanical descriptions of the interaction of light with matter, spectroscopic instrumentation, the fundamental principles of laser action, and some specific techniques of laser spectroscopy (such as persistent spectral hole burning, single molecule spectroscopy, cavity ringdown spectroscopy etc.). It is the objective of this class to provide the student with an in-depth knowledge of these topics so that spectroscopic methods can be successfully applied to the student's research projects.

### Required Textbook

Wolfgang Demtröder: "Laser Spectroscopy 1: Basic Principles" (496 pages), Springer-Verlag Berlin Heidelberg, 2014. ISBN 978-3-642-53858-2. Available in hardcover and eBook format for purchase or rent.

Also recommended (optional):

Wolfgang Demtröder: "Laser Spectroscopy 2: Experimental Techniques" (757 pages), Springer-Verlag Berlin Heidelberg, 2015. ISBN 978-3-662-44640-9.



Prior editions of the textbook(s) may be substituted for the newer editions; volumes 1 and 2 were combined in a single volume in the 3rd and earlier editions.

### Supplemental Textbooks

- Donald A. McQuarrie and John D. Simon: "Physical Chemistry: A Molecular Approach", University Science Books, 1997. [UWM Libraries Call Number: QD453.2 .M394 1997.](#)
- Ira N. Levine: "Physical Chemistry", McGraw-Hill, 1978. [UWM Libraries Call Number: QD453.2 L48.](#)
- Ira N. Levine: "Molecular Spectroscopy", Wiley, 1979. [UWM Libraries Call Number: QC454 M6 L48.](#)
- Donald A. McQuarrie: "Mathematical Methods for Scientists and Engineers", University Science Books, 2003. [UWM Libraries Call Number QA37.3 .M36 2003.](#)

### Course Prerequisites

Graduate student status.

### Lectures

Your attendance of all lectures is expected. This is a graduate level class, and I expect you to take the necessary steps to take ownership of the material. You know best whether you have truly understood a particular topic and whether you need to read up on it using a different textbook from the library, try to solve more on problem sets, or seek the help of your instructor; please use the available options accordingly.

### Course Website

Desire2Learn (D2L): [D2L.uwm.edu](http://D2L.uwm.edu). For information on how to use and access D2L, please consult [uwmltc.org/?p=870](http://uwmltc.org/?p=870).

Problem sets will be given at irregular intervals and, together with solutions and other course material, be made available on D2L. Visit the course website regularly as important information and announcements may be posted there as well.

### Grading

The class is *not* graded on a curve. The course grade will be based on:

Midterm (take-home)	30%
Final Exam (in-class)	40%
Special Topic Student Seminar	25%
Student Performance	5%
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Total	100%

The *Midterm* is a take-home exam and will be handed out in class and posted to D2L after the lecture. It will cover all topics discussed in class and problem sets in a format similar to the problem sets. No class will be held on Tuesday during midterm week (October 25, 2016).

No time extensions or make-up exam will be given for the take-home midterm. If you are unable to turn it in during class, you may upload it to the D2L dropbox.

The *Final Exam* is comprehensive.

Auditors will not be graded, and will not be required to participate in exams, but are required to attend all classes.

### Tentative Schedule

Week		Topic
1	Sep 6 - Sep 9	<b>Absorption and Emission of Light</b> (black body radiation, photometric quantities, polarization of light, absorption and emission spectra, transition probabilities, coherence)
2	Sep 12 - Sep 16	
3	Sep 19 - Sep 23	
	<a href="#">Oct 3</a>	<a href="#">Last day to drop full term courses without W on record</a>
4	Sep 26 - Sep 30	<b>Widths and Profiles of Spectral Lines</b> (natural linewidth, Doppler broadening, collisional broadening, transit-time broadening, homogeneous and inhomogeneous broadening, power broadening)
5	Oct 3 - Oct 7	
6	Oct 10 - Oct 14	
7	Oct 20	<b>Midterm (take-home)</b> - no class on Tuesday, Oct 25
7	Oct 17 - Oct 21	<b>Spectroscopic Instrumentation</b> (spectrographs, monochromators, interferometers, wavelength measurements, detectors)
8	Oct 24 - Oct 28	
	<a href="#">Oct 28</a>	<a href="#">Last day to drop or withdraw from full-term courses</a>
9	Oct 31 - Nov 4	<b>Lasers</b> (laser resonators, experimental realization, wavelength tuning)
11	Nov 14 - Nov 18	
12	Nov 21 - Nov 22	
	Nov 23 - Nov 27	Thanksgiving Recess

Week		Topic
13	Nov 28 - Dec 2	<b>Spectroscopic Methods</b>  (absorption spectroscopy, fluorescence excitation spectroscopy, persistent spectral hole burning spectroscopy, single molecule spectroscopy, multiphoton spectroscopy, coherent anti-Stokes Raman spectroscopy etc.)
14	Dec 5 - Dec 9	
15	Dec 13	<b>Research Project Presentation</b>
	Dec 13	<b>Final Exam (take-home)</b>

### Policies

If you will need accommodations in order to meet any of the requirements of this course, please contact me and the Student Accessibility Center (SAC) as soon as possible. Special accommodations for students with disabilities can be provided, but their timely implementation can only be insured if the SAC is contacted ahead of time. For details see [www4.uwm.edu/sac/SACltr.pdf](http://www4.uwm.edu/sac/SACltr.pdf).

*Department of Chemistry and Biochemistry policies* are posted on bulletin boards in the department.

*UWM policies* related to students with disabilities, religious observances, students called to active military duty, incompletes, discriminatory conduct, academic misconduct, complaint procedures, grade appeal procedures, and final examination requirements can be consulted at [http://www4.uwm.edu/secu/news\\_events/upload/Syllabus-Links.pdf](http://www4.uwm.edu/secu/news_events/upload/Syllabus-Links.pdf).

### Academic Misconduct

Cheating on an exam or other graded material will automatically result in a grade of zero (as a minimum consequence); failure in the course and referral to the Dean may also occur. **Academic dishonesty in any form will not be tolerated.**

*“Academic misconduct is an act in which a student seeks to claim credit for the work or efforts of another without authorization or citation, uses unauthorized materials or fabricated data in any academic exercise, forges or falsifies academic documents or records, intentionally impedes or damages the academic work of others, engages in conduct aimed at making false representation of a student's academic performance, or assists other students in any of these acts.”*

*“Prohibited conduct includes cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment as one's own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; stealing examinations or course materials; submitting, if contrary to the rules of a course, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally*

*assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.”*

(From: Office of the Provost and Vice Chancellor)