

Instructor: Daniel Reisenfeld
Office: Science Complex Office SC 121, Lab: SC 010
Phone: 243-6423
Text: *Introduction to Quantum Mechanics (2nd Edition)* by David J. Griffiths (Prentice Hall, 205)
Lectures: MWF, 2:10 – 3:00. SC Room 231
Office Hours: Right after class for short questions, otherwise (1 hour slots) W 1, Th 10, F 10,
and other times when you can catch me.
Course web site: <http://www.physics.umd.edu/phys462/> The course web page will contain
course information, syllabus, assignments, and solutions.

Description:

This class will cover advanced topics in quantum mechanics, with applications from contemporary atomic physics. Whereas the first semester concentrates on formalism, this course introduces the approximation methods necessary to analyze real systems. Topics include non-degenerate, degenerate and time dependent perturbation theory, interactions of atoms with light, and scattering theory. Applications include atomic structure, laser cooling, atomic clocks, Bose-Einstein condensates, and electron-atom collision experiments.

Prerequisites:

Physics 461 (Quantum Mechanics I) or permission of instructor.

Grading:

Midterm exams: 35% (17.5% each)
Homework: 40%
Final exam: 25%

Homework:

Homework will be assigned weekly. The assigned problems will be collected, graded, and returned. Homework will be due at the *beginning* of class on the specified date, typically Fridays. If an assignment is turned in on the due date after class has started *without prior approval from instructor*, the grade will be **20% less** than that earned, and will decrease by an **additional 20% for each day late** (excluding weekends and holidays). Assignments handed in five or more days after the due date will receive no credit. If you have a conflict with the due date, it is recommended that you turn in the assignment early or talk to me ahead of time to see if other arrangements can be made. You are encouraged to work together on the homework problems and to see me if you need hints; however, the work you turn in must be your own.

Exams:

There will be two mid-term exams and a final exam. The final, which will be on Thursday, May 8 from 3:20 pm to 5:20 pm, will be semi-comprehensive, emphasizing the material in the last part of the course. Exams will be self-scheduled (any two hour block on the specified days) and you may bring one sheet of paper with anything written on it that you want. Make-up exams may be given in exceptional circumstances, but only if arranged in advance.

Drop/Add/Auditing:

Drop/Add can be performed online until **February 11th**, and with the instructor's and advisor's signatures until **March 4th**. Last day to drop with petition is **May 2nd**. Students interested in **auditing** the course must choose so on or before **February 11th**.

Instructor's Caveat:

In this course I am attempting to blend the traditional content of a second semester quantum mechanics class with an applications-based approach. Much of the material presented later in the semester is not from one particular source, but a collection which has not yet been finalized. In addition, since I am not sure at what pace this latter material can be presented, the syllabus presented here is tentative. Despite this uncertainty, I think we will have a lot of fun, as my goal is to introduce the student to the exciting developments in quantum mechanics in the last few decades.

Targeted Course Syllabus

| Week | Week of | Topics | Chapter |
|------|---------|---|--------------------|
| 1 | 01/21 | (Monday holiday) Course Introduction Time-Independent Perturbation Theory (PT) | 6.1 |
| 2 | 01/28 | Degenerate PT, The <i>Real</i> Hydrogen Atom | 6.2 – 6.3 |
| 3 | 02/04 | Zeeman Effect, Hyperfine Splitting | 6.4 – 6.5 |
| 4 | 02/11 | Two-Particle Systems, Many-Electron Atoms | 5.1, 5.2 |
| 5 | 02/18 | (Monday Holiday) Variational Principle & Helium | 7.1 – 7.2 |
| 6 | 02/25 | Exam 1 (2/25-2/26) , WKB Approximation | 8.1 – 8.3 |
| 7 | 03/03 | Time Dependent PT; Two Level Systems, Rabi Oscillations | 9.1 |
| 8 | 03/10 | Emission and Absorption of Radiation | 9.2 |
| 9 | 03/17 | Spontaneous Emission and Selection Rules The Basic Atomic Clock | 9.3 Supplements |
| 10 | 03/24 | Spring Break | |
| 11 | 03/31 | Laser Cooling, Forces on Atoms from Light | Supplements |
| 12 | 04/07 | Exam 2 (4/07-4/08) , Atomic Clocks, Magneto-Optic Traps | Supplements |
| 13 | 04/14 | Bose-Einstein Condensates, Scattering I | Supp, 11.1 |
| 14 | 04/21 | Scattering II | 11.2-11.4 |
| 15 | 04/28 | Wrapup | |
| 16 | 05/08 | Final Exam Thursday, 3:20 pm – 5:20 pm | |

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

All students need to be familiar with Student Conduct Code. The Code is available for review online at <http://www.umt.edu/SA/VP/SA/index.cfm/page/1321>.

If you require special testing conditions or classroom facilities please let the instructor know during the first couple weeks of class.