

PHYSICS 5301: QUANTUM MECHANICS I

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Schedule: Tue + Thu, 9:30 - 10:50, Sci 112

Textbook: R. Shankar, *Principles of Quantum Mechanics*, 2nd ed. (Kluwer, NY, 1994)

PHYS 5301:

1. **Introduction to QM** (more than in chapter 3)
2. **Mathematical background and notation needed for QM** (chapter 1)
3. **From Classical Mechanics to QM: key points of the Lagrange and Hamilton formulations** (chapter 2)
4. **Postulates of QM** (chapter 4, parts of chapter 9)
5. **Problems in 1 dimension: free particle, potentials, harmonic oscillator, tunneling** (chapter 5+7)
6. **3D problems: angular momentum, free particle, harmonic oscillator, H atom** (parts of chapters 11-13)
7. **The spin** (chapter 14), **addition of angular momenta** (chapter 15)

PHYS 5302:

1. **Review: key results of PHYS 5301**
2. **Time-independent perturbation theory** (chapter 17)
3. **Time-dependent perturbation theory** (chapter 18)
4. **Systems of identical particles** (parts of chapter 10)
5. **Scattering theory** (parts of chapter 19)
6. **Introduction to relativistic QM** (parts of chapter 20)
7. **Special project to be selected by the students**

Grades:

Homework will be assigned on a regular basis and discussed in class after the due date. It is OK to work in small groups. Homeworks will not be collected or graded, but you must understand the problems assigned and be able to work them out: They are an important part of the tests! You must have understood the homework in order to be able to do well on the tests.

Three in-class *tests* are scheduled for Tuesday September 23 (HW 1+2), Tuesday October 22 (HW 3+4), and Tuesday November 26 (HW 5+6). They will consist of general questions from the lecture (including material in the book and hand-outs) and problems picked from the homework (or almost identical).

The *final* will be comprehensive. The official schedule has our final on Wednesday December 10, in class, from 7:30-10:00. For those who have this "not a morning person" bug, this is indeed a.m. Sorry. I can't change that.

The *semester average* is calculated as $0.25 \cdot (\text{test1} + \text{test2} + \text{test3} + \text{final})$.

Grades: A = 100-86; B = 85-72. Should you decide to perform below that, C's extend from 71 to 62 and D's from 61 to 52. Don't make an F.

Objectives:

- ...develop an understanding of the foundations of QM, including the failures of classical mechanics and the basic postulates that are needed to explain those failures and provide the foundations of QM,
- ...become familiar with the mathematical tools and notation necessary to formulate and solve problems in QM,
- ...be able to solve 1D and 3D potential problems in QM, with a deep understanding of the role of angular momentum.

Outcomes:

After completing this course, graduate students should be

- ...familiar with all the postulates of QM, their physical meaning and implications,
- ...comfortable with the mathematical tools specific to QM including the $\langle \text{bra} | \text{ket} \rangle$ notation,
- ...able to formulate and solve 1D and 3D problems in QM.

In-class discussion, questions and problems in the homework, tests, and final will address the attainment of these issues.

Students with disabilities:

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405.

Religious holy days:

Texas House Bill 256 requires institutions of higher education to excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day. The student shall also be excused for the time necessary to travel. An institution may not penalize the student for the action and allows for the student to take an exam or complete an assignment from which the student is excused. No prior notification of the instructor is required [**note added**: but would be highly appreciated because exams in this class are easy to reschedule].