

# PHY373 Quantum Mechanics

First Day Handout Fall 2017

**Class Meetings:** Unique number 56420 (MWF 10:00 - 11:00 pm) RLM 7.104 Optional discussion section to be arranged.

**Instructor:** Greg O. Sitz, Office: RLM 10.313, Office Hours: Office Hours: Wednesday and Thursday 1-2 or by appointment. Phone: 471-0701, email: [gositz@physics.utexas.edu](mailto:gositz@physics.utexas.edu)

**Grader:** TBA email: [tba@physics.utexas.edu](mailto:tba@physics.utexas.edu)

**Prerequisites:** PHY336K Classical Dynamics I (not essential) and PHY355, Introduction to Modern Physics (this will be enforced, for good reason).

**Text - *Introduction to Quantum Mechanics*** Second Edition, by *David J. Griffiths*. As an alternative or supplement, you can use Richard Fitzpatrick's free, on-line text:

<http://farside.ph.utexas.edu/teaching/qmech/qmech.html>

The material covered and the order in which it will be covered are shown on the next page.

**Grading** - The breakdown is: Homework 20%, In-class exams: 40%, Final Exam 40%. Homework and test scores will be weighted as just described and a composite score ( $S$ ) of between 0 and 100 for the course will be calculated. The final grades for the course will be determined using this composite score as follows:  $S \geq 85 \Rightarrow A$ ;  $85 > S \geq 70 \Rightarrow B$ ;  $70 > S \geq 60 \Rightarrow C$ ;  $60 > S \geq 50 \Rightarrow D$ ;  $50 > S \Rightarrow F$ . The composite score will not be rounded, that is 84.99 is less than 85.

- **Homework - 20% of grade** - Homework will be assigned approximately weekly during the semester. All homework assignments will be weighted equally (even though they may cover different amounts of material and have different numbers of problems). The lowest score will be dropped in computing the average.
- **In-class Exams - 40%** - Two in-class exams will be given: dates are Oct. 13 and Nov. 17. Each will be worth 20%. If you miss one or both of the in-class exams, the weight for the final will be increased by 20% for each one missed.
- **Final Exam - 40%** The final is comprehensive and it is *required*. It is scheduled for Friday, December 15, 2:00 to 5:00 pm. If you score higher on the final than on either one (or both) of the in-class exams, your score on the final will be substituted for the score on that in-class exam.

The exams will be closed book and closed notes, and no calculators or other aids of any type are allowed. A cover sheet with relevant formulas and constants will be provided. This cover sheet will be available in advance of the exams. The final exam will be cumulative, and the best way to prepare for the final is to keep up with the material as it is covered in class. This means being prepared for and taking all the in-class exams.

Unless a *substantial* illness or family emergency is documented with a note from a physician or the dean's office, no make-up exams will be given. Any potential absences must be discussed with Dr. Sitz *prior* to the exam in order to have a make-up. Make-up exams will be oral and taken within 72 hrs. of the missed exam.

If you are absent from an examination for the observance of a religious holy day you may complete the work missed within a reasonable time after the absence, if proper notice has been given. Notice must be given at least seven days prior to the exam.

**Philosophy:** There are two main goals for this course. The first is to achieve basic competency in manipulation of the fundamental equations of non-relativistic quantum mechanics, that is in how

to *do* quantum mechanics. This part is not as challenging as, say, classical electrodynamics. The second goal is, along the way, to spend some time thinking about the results of quantum mechanics *mean*. This is harder but more interesting.

**Other:** The last day to drop the course for academic reasons is November 7, 2017. The last day to drop a class, with the required approvals, is December 11, 2017.

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-6441 TTY.

**Alternatives:** This document (as well as other course related material, including homework and test scores) will be available on Canvas.

## Syllabus

Week of

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|---------------|---|
| August 30:    | Review, The Schrödinger equation and $\Psi(x, t)$ (Griffiths, Sections 1.1-1.4)     |
| September 6:  | momentum, uncertainty (Section 1.5-1.6), Time independent problems I                |
| September 11: | Infinite and finite square well (Sections 2.1-2.2, 2.6)                             |
| September 18: | the harmonic oscillator (Section 2.3) free particle (Section 2.4)                   |
| September 25: | delta function potential (Section 2.5) barriers (Section 2.6)                       |
| October 2:    | more barrier problems (Section 2.6), Formalism, Hilbert space (Section 3.1-3.2)     |
| October 9:    | Operators, observables, Dirac notation (Section 3.3-3.6) and Test 1 (on October 13) |
| October 16:   | QM in 3-D, variable separation, angular equation (Section 4.1)                      |
| October 23:   | The hydrogen atom, the radial equation (Section 4.2)                                |
| October 30:   | Angular momentum (Section 4.3)  |
| November 6:   | Spin (Section 4.4)  |
| November 13:  | Addition of angular momentum (Section 4.4.3) and Test 2 (on November 17)            |
| November 20:  | Identical Particles, multi-electron atoms (Sections 5.1 and 5.2)                    |
| November 27:  | Solids and band structure (Section 5.3)   |
| December 4:   | TBA   |
| December 11:  | Review and Final Exam (on December 15)  |

## Quotes

“I think I can safely say that nobody understands Quantum Mechanics” -R. P. Feynman

“If quantum mechanics hasn’t profoundly shocked you, you haven’t understood it yet.” - Niels Bohr

“How often have I said to you that when you have eliminated the impossible, whatever remains, however improbable, must be the truth?” - Sherlock Holmes (Sir Authur Conan Doyle)

“The paradox is only a conflict between reality and your feeling what reality ought to be.” -R. P. Feynman

“It appeared to me that hydrogen . . . more than any other substance is destined to open new paths to the knowledge of the structure of matter and its properties.” -Johann Jacob Balmer (1884)

“We have here a very striking and general example of the breakdown of classical mechanics - not merely an inaccuracy in its laws of motion, but an *inadequacy of its concepts to supply us with a description of atomic events*” -P. A. M. Dirac

“If you get there and the Waffle House is closed? That’s really bad. That’s when you go to work.” -Craig Fugate, Director of FEMA