Professor Tim Cohen

PHYS 414

Quantum Physics

Fall 2016

MW, 10:00 - 11:50 am

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Course website (Canvas): `https://canvas.uoregon.edu/courses/70024`

This syllabus serves to establish the rules of the course and a sense of what material will be covered. Note that some aspects may evolve as the semester progresses.

Course Description: The purpose of this course is to introduce the subject of Quantum Mechanics. An attempt will be made to strike a balance between developing an understanding of the formal structures along while making contact with as many practical applications as possible. In particular, the goal of this quarter will be to learn how to compute wave-functions using the time-independent Schrdinger equation, and to develop an understanding of Hilbert spaces and all the associated mathematical technology.

Prerequisite(s): PHYS 413.
Credit Hours: 4

Required Text: *Introduction to Quantum Mechanics*, 2nd Edition
Author: David J. Griffiths; **ISBN-13:** 978-0131118928

Supplementary Text: *A Modern Approach to Quantum Mechanics*, 2nd Edition
Author: John S. Townsend; **ISBN-13:** 978-1891389788

Supplementary (Advanced) Text: *Lectures on Quantum Mechanics*, 2nd Edition
Author: Steven Weinberg; **ISBN-13:** 978-1107028722

Course Objectives:

At the completion of this course, students will have knowledge of the following topics:

1. The Stern-Gerlach experiment/simple two-state quantum systems
2. The wave-function and the matrix mechanics approaches to QM.
3. Solving the time-independent Schrdinger equation and interpreting the solutions.
4. Infinite square well, simple harmonic oscillator, delta-function potential, finite square well.
5. Hilbert Spaces, Eigenvalues, Eigenvectors, basis vectors, discrete and continuous bases.
6. Commutators and compatibility of observables.
7. The Heisenberg Uncertainty Principle
8. Basics of multi-body systems and quantum statistical mechanics.

Grade Distribution:

Homework	25%
Midterm Exam	35%
Final Exam	40%

Letter Grade Distribution:

A	≥ 90
B	< 90 and ≥ 80
C	< 80 and ≥ 70
D	< 70 and ≥ 60
F	< 60 and ≥ 50

Note that + and − beyond the letter grades will be assigned as appropriate. I reserve the right to curve grades up if I feel it is warranted.

Course Policies:

- **General**
  - The course is scheduled for 1:50. Your default assumption should be that I will use the full time. I will give a few minute break after around an hour to stretch your legs and use the restroom.
  - I will not take roll. It would be surprising if you could pass this course without attending class. You are responsible for your own education.
  - Computers and tablets are not to be used. If you think you can take notes with your device, discuss it with me and if I will consider granting an exception.
  - Cell phones should be silenced, and are not allowed to show their glowing little faces.
- **Exams**
  - Exams are in class, closed book, closed notes.
  - **No makeup exams will be given unless previously discussed.**
  - The final is scheduled for Thursday, December 8 at 10:15 am.
- **Homework Assignments**
  - Homework will be assigned every Monday.
  - Homework is due at the beginning of class each Monday.
  - I reserve the right to change the homework schedule as needed.
  - **No late assignments will be accepted under any circumstances**.
  - The final homework will be assigned during dead week.
  - Each homework problem will be graded on a $\checkmark^+$, $\checkmark$, $\checkmark^-$, $\emptyset$ scale. Problems can be weighted as different percentages of the total score.
  - The lowest homework will be dropped.
  - Solutions to the homework will be posted online (via canvas) in a timely fashion.
  - It is *highly* recommended that you work on the homework together in groups (but of course you must turn in your own work).

Academic Honesty:

Clearly cheating is not acceptable. In particular, you might find solutions to the assigned problems online. You might also have friends who took the course last year and gave you my solutions. Use of any of these solutions is not allowed. If it becomes clear that your homework is derived from the online solutions then disciplinary action will be taken.

The UO policy on academic honesty can be found here
`https://uodos.uoregon.edu/StudentConductandCommunityStandards/AcademicMisconduct.aspx`

(Very) Tentative Course Outline:
QM is very confusing and it is unlikely that just listening to lectures and working problems is enough. In other words, I highly recommend reading our book (and others). This schedule will give you a sense of the topics I hope to cover and the pace I would like to keep. We have some buffer time built in in case we fall behind.

Week	Content
9/26 (M)	• Review syllabus • Why Quantum Mechanics? • Reading assignment: Weinberg, Ch. 1
9/28 (W)	• Two-state systems (Stern-Gerlach) • Reading assignment: Townsend, Ch. 1
10/3 (M) and 10/5 (W)	• The Wave Function • Reading assignment: Ch. 1
10/10 (M)	• Stationary States • Reading assignment: Ch. 2.1
10/12 (W)	• The Infinite Square Well • Reading assignment: Ch. 2.2
10/17 (M) and 10/19 (W)	• The Harmonic Oscillator • Reading assignment: Ch. 2.3
10/24 (M) and 10/26 (W)	• Free Particle, Delta-Function Potential, Finite Square Well • Reading assignment: Ch. 2.4, 2.5, 2.7
10/31 (M)	• Mid-term Review/Buffer day
11/2 (W)	• **Tentative Mid-term**
11/7 (M) and 11/9 (W)	• Hilbert Space, Observables, Eigenfunctions, Generalized Statistical Interpretation, Dirac Notation • Reading assignment: Ch. 3.1, 3.2, 3.3, 3.4, 3.6
11/14 (M)	• The Uncertainty Principle • Reading assignment: Ch. 3.5
11/16 (W)	• Formalizm buffer day • Reading assignment: Ch. 3
11/21 (M)	• Two-Particle Sytstems • Reading assignment: Ch. 5.1
11/23 (W)	• No class
11/28 (M)	• Solids and Quantum Statistical Mechanics • Reading assignment: Ch. 5.3, 5.4
11/30 (W)	• Buffer/review