PHYS 36000 - Quantum Mechanics

MWF at 9:30 - 10:20, in Felix Haas Hall G066
Prerequisites: PHYS 310, 330, & 342 or equivalents

Instructor:

Professor Stephen M. Durbin
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765-494-6426
Office: PHYS 166
Office hours: Wed 10:30-11:30 am or by appointment

Required Textbook:

"Quantum Mechanics - Theory and Experiment" by Mark Beck, Oxford University Press (2012)

NOTE: There is online access to this book from the Purdue Library:
Quantum Mechanics by Mark Beck.

Recommended books:

"Quantum Mechanics for Tomorrow's Engineers" by Junichiro Kono, Cambridge University Press (2023)
"Introduction to Quantum Mechanics, Third Edition," David J. Griffiths & Darrell F. Schroeter"

Course description:

This is an introductory course on Quantum Mechanics. It employs a modern textbook that is a good introduction to quantum information science as well as traditional quantum mechanics. Topics include quantum states, operators, measurement and the fundamental postulates of quantum mechanics, spin, angular momentum, and two-particle systems with entanglement. This allows for dedicated lectures on quantum cryptography, EPR and local realism, quantum computing, and the role of decoherence in Schrödinger's cat. The course finishes with the time-dependent Schrödinger Equation, indeterminancy, the harmonic oscillator, and the hydrogen atom.

Lectures

Students are responsible for attending all lectures. Lecture notes will generally be posted.

Learning outcomes:

- understand the idea of a quantum state
- understand the unique features of entangled states and how they can violate local realism
- understand the quantum mechanical description of the measurement process and concepts such as complementarity and the uncertainty relation
- understand the basics of quantum computing
- solve the Schrödinger equation for the continuous case for simple potentials such as the square well and the harmonic oscillator

- ability to solve eigenvalue problems for energy, momentum, angular momentum, and central potentials and explain the idea of spin

Grades

The final course grade will be based on these components:
Homework - 30%
Midterm Exam 1 - 20%
Midterm Exam 2 - 20%
Final Exam - 30%

Homework assignments will be posted on the Calendar tab of this web page and on Brightspace at least one week ahead of their due dates, which are on Fridays at 5 pm. There are eleven assignments; the lowest grade will be dropped. Late assignments turned in by the Monday after the due date will worth 75% credit. After Monday late assignments will not be graded. Homework problems must have complete written solutions that are easy to follow for grading. Illegible work will not be graded.

Students are encouraged to collaborate on solving homework problems. Each student's submissions, however, must be in that student's own words and represent their own thinking. Collaborating students should never submit identical solutions.

Midterm exams will be held on Friday Feb 16 and Friday April 5 during the regular lecture time.

The final exam will be in-person at the time and place assigned by the University. It will be comprehensive, covering the entire course.

Grade Cut-offs

The following cutoffs are intended:
90% and above = A-, A, A+
80% and above but less than 90% = B-, B, B+
70% and above but less than 80% = C-, C, C+
60% and above but less than 70% = D-, D, D+
Below 60% = F

The cut-offs for +/- grades will be set by the instructor. The instructor also reserves the right to make the overall grade cut-offs somewhat more generous, but they will not be made less generous.