

PHYC 464 Quantum Mechanics 1

Course Description

DeBroglie's postulate, the uncertainty principle, the Schrodinger equation, the free particle, square well potentials, harmonic oscillator, the hydrogen atom, angular momentum and other selected wave mechanics problems. No regularly scheduled laboratory. (3 credit hours)

Prerequisite PHYC 260.

Course Objective

The objective of this course is to provide a deeper understanding of the quantum concept of nature and provide practice in working out specific examples using quantum mechanics methods.

It is also to offer the student a rigorous development of the outstanding concepts of quantum mechanics; to develop a background sufficient to allow the student a more knowledgeable reading of current research and background to attack problems in the workplace.

Course Rationale

By an emphasis upon quantum wave nature of physics as a method for attacking a great variety of problems in the physical sciences.

By understanding the behavior of quantum mechanical systems with examples from theory and multimedia-capable computer software.

This course will be immensely helpful for students who want to pursue their specific research areas such as nuclear physics, condensed matter physics, engineering, and any related field.

Course Content, Format, and Bibliography

Content

Particles and Waves

DeBroglie's postulate

The statistical interpretation

The uncertainty principle

The time-independent Schrodinger's Equation

Energy quantization and eigenfunctions

The infinite square well

The step potentials and delta-function potential

The free particle

The finite square well and barrier potentials

The harmonic oscillator.

Formalism

Linear algebra and function spaces

Expectation values and differential operators

The generalized statistical Interpretation

Quantum mechanics in three dimensions

Schrodinger's equations in spherical coordinates

The hydrogen atom

Addition of angular momentum

Spin

Format

Course activities will center around the lectures and assigned problems. It will be expected that the student will study several references during the course. The computer-generated animations are used to introduce, motivate, and illustrate the concepts of quantum mechanics.

This course is taught as a dual undergraduate/graduate course. Students will be required to complete activities appropriate for the level of the course in which they are enrolled. Student performance on homework, exams and/or labs will be evaluated using different standards for undergraduate and graduate students.

Bibliography

Griffiths, *Intro. to Quantum Mechanics*, 2nd Ed., Prentice Hall, ISBN 0-13-111892-7

Introductory Quantum Mechanics, 4th edition, Richard L. Liboff

Quantum Mechanics, Richard W. Robinett