PHYC 564 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.

Not open to students who have credit in PHYC 464.

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

Identical particles
  Two-particle systems
  Atoms and solids
  Quantum statistical mechanics
Time-independent perturbation theory
  Nondegenerate perturbation theory
  Degenerate perturbation theory
  The finite structure of hydrogen
The Zeeman effect

Hyperfine splitting

The variational principle and WKB approximation

Variational method

The ground state of helium

The hydrogen molecule

The classical region and tunneling

Time-dependent perturbation theory

Two-level systems

Emission and absorption of radiation

Spontaneous emission

Scattering

Quantum scattering theory

Partial wave analysis

The Born approximation

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.

Extra assignments for graduate level counterpart of taught/with course:

Graduate students in taught/with course will be assigned one or more of the following, at the instructor's discretion, commensurate with the higher requirements of the graduate component as compared with the undergraduate component:

Extra problem assignments

Course term paper

Individual experimental project

Extra or different examination requirements

Oral examination

Class lecture on assigned topic

Assigned readings/report on the literature
Bibliography


*Introduction to Nuclear Physics*, by Harald A. Enge


*Quantum Mechanics*, Richard W. Robinett