

DETAILED COURSE DESCRIPTION

Course Number PHYS 250

Course Title Fundamentals of Physics: Modern Physics

Target audience The course is designed for sophomore level physics majors and minors.

Prerequisites An introductory physics sequence (PHYS 135/136 or PHYS 137/138 or EF150/151 & PHYS 231/232) and calculus (MATH 141/142)

Catalog description: Fundamental concepts of modern physics developed in early 20th century: special relativity, particle/wave duality, first look at the Schrodinger equation and some solutions.

Expected previous knowledge

Concepts Waves and resonances, derivatives and integrals, electromagnetism

Skills Able to calculate derivatives and integrals, manipulations of trigonometric functions, solving equations with logs and exponents

Course Objectives

The objectives are: 1) Introduce students to concepts in modern physics. 2) Introduce major experiments in modern physics. 3) Perform basic calculations in modern physics. 4) Improve laboratory skills. 5) Introduce mathematical concepts useful for advanced physics classes and hone problem solving skills.

Sample Text

“Modern Physics”, Taylor/Zafiratos/Dubson, Addison-Wesley.

Minimum Material Covered

Waves and Light – diffraction & interference, wave packets (conceptually), wave equations

Quantum mechanics – wave/particle duality, photoelectric effect, Schrödinger equation, wave functions, simple problems, angular momentum, tunneling, electron spin, Stern-Gerlach experiment

Atoms – solution to SWE for hydrogen, multi-electron atoms, build up of periodic table from solution to SWE

Relativity – length contraction, time dilation, relativistic doppler shift, twin paradox, Michaelson-Morley experiment

Mathematical concepts - Fourier transforms and Fourier Series (at a basic level), manipulations of complex numbers, practice solving physics problems with calculus

Supplementary Topics (as time allows)

Quantum effects in large systems – lasers, semiconductors

Nuclear physics – shell model (SHO only, no angular momentum effects), nuclear decay, fission, radiation

Particle physics – particles in the standard model, particle detectors