

Phys 360 – Modern Physics II - 3 credits

Bulletin Description:

Continuation of modern physics covering statistical mechanics, solid state physics, nuclear physics and particle physics with an embedded modern physics laboratory. The laboratory contains experiments such as atomic and molecular spectroscopy, electron diffraction, nuclear spectroscopy, photoelectric effect, Millikan oil drop, chaotic pendulum, Brownian motion, Michelson interferometry, single photon interference and muon detection. The laboratory focuses on developing modern experimental skills including image analysis and computerized automation. Prereq: PHYS 350.

Course Objectives:

This course introduces students to several modern topics in physics and develops the basic skills and knowledge required to understand each topic. Students will develop statistical methods of thinking and apply them to classical and quantum mechanical systems. Students will be introduced to crystal structure and the basic influences of a crystal lattice on electronic motion. Several modern solid state electronic devices are examined. The historical development of particle and nuclear physics will be investigated. The laboratory will give students the opportunity to re-create many of the experiments critical to the development of modern physics and will gain basic experimental technical skills including error analysis. Students will practice technical writing.

Content Listing:

- **Experimental Skills:** Graphing, current/voltage measurement, micrometers, Fourier analysis, error analysis.
- **Statistical Mechanics:** Basic probability, Boltzmann Distribution, kinetic theory, quantum particles, Fermi-Dirac and Bose-Einstein distributions, Bose-Einstein condensation, free-electron model.
- **Solid State Physics:** Crystal structure, Bravais lattices, Bloch theory, conduction, scattering, band gaps, charge carrier density, intrinsic and doped semiconductors, PN junctions, Transistors.
- **Nuclear Physics:** Nuclear structure, binding energies, SEMF, radioactive decay, alpha decay, beta stability, gamma decay, nuclear shell model, magic numbers.
- **Particle Physics:** Classification of particles, conservation laws (momentum, energy, charge, lepton number, baryon number, strangeness, charm), symmetries, parity, CPT conservation, Feynman diagrams.