PHYS 112: COLLEGE PHYSICS B

Citrus College Course Outline of Record

Heading	Value
Effective Term:	Fall 2021
Credits:	4
Total Contact Hours:	108
Lecture Hours :	54
Lab Hours:	54
Hours Arranged:	0
Outside of Class Hours:	108
Prerequisite:	PHYS 111.
Strongly Recommended:	ENGL 101.
District General Education:	B2. Natural Sciences - Physical Sciences, B3. Natural Sciences - Laboratory
Transferable to CSU:	Yes
Transferable to UC:	Yes - Approved
Grading Method:	Standard Letter

Catalog Course Description

The second of two trigonometry-based physics courses covering optics, electromagnetism and modern physics with an emphasis on how these concepts apply to biological systems. This course is designed for students planning to enter medicine, dentistry, pharmacy, optometry, forestry, and (4 year) nursing. (For transfer as a calculus-based physics course, students must take PHYS 112C.) 54 lecture hours, 54 lab hours.

Course Objectives

- OPTICS
- Understand color and dispersion.
- ELECTROMAGNETISM
- Understand the charge model and use it to explain basic electric phenomena & develop an atomic-level understanding of the charge model.
- Use Coulomb's law to calculate the electric force between charges.
- Determine the electric fields from charge distributions; calculate forces and torques on charges in electric fields.
- Understand electric potential energy and electric potential, and use them in conservation of energy problems; understand the connection between potential and field.
- Find and use the electric potential of point charges, charged spheres, and parallel-plate capacitors; understand capacitors and dielectrics.
- Understand how charge moves through a conductor; understand and apply a basic model for current, including conservation of current; understand how a battery creates a current in a circuit.
- Draw and interpret basic circuit diagrams; understand the physical basis for Kirchhoff's laws and use these laws to analyze circuits.
- Develop an electrical model for signal propagation in the nervous system.
- Understand and use the wave model of light and the ray model of light.
- Develop a dipole model of magnetism, analogous to the charge model of electricity, that allows students to understand and reason about basic magnetic phenomena; develop a simple atomic-level model of ferromagnetism.
- Understand the magnetic fields due to currents in wires, loops, and solenoids and understand the magnetic forces and torques on moving charges, wires, and current loops.
- Understand the circumstances under which changing magnetic fields lead to induced currents and use Lenz's law and Faraday's law to determine the direction and size of induced currents; understand how the movement of a conductor through a magnetic field leads to a motional emf.
- Understand how induced electric and magnetic fields lead to electromagnetic waves; apply wave and photon models to the electromagnetic spectrum; understand the properties of different types of electromagnetic waves.
- Understand the relationships between AC currents and AC potentials in resistors, capacitors, and inductors; understand inductors and inductance; understand the oscillatory behavior of circuits with inductors and capacitors.
- MODERN PHYSICS
- Understand the experimental evidence for our understanding of matter, its wave nature and the quantization of energy.
- Understand the Bohr model of the atom and use a quantum-mechanical model of the hydrogen atom; understand how lasers work.
- Recognize continuous and discrete spectra; understand multielectron atoms and their spectra; apply quantum ideas to molecules and molecular fluorescence.
- Understand the structure and composition of the nucleus; understand the forces that hold the nucleus together and under what circumstances it might break apart.
- Calculate the interference patterns of double slits and diffraction gratings.
- Distinguish between the different types of radioactive decays and compute the daughter nuclei for these decays; use the concept of half life to determine the age of a radioactive sample.
- Develop a basic understanding of some applications of nuclear physics.
- Understand the conditions for constructive and destructive interference in thin films.
- Understand the spreading of waves due to diffraction and understand how light diffracts through single slits and circular apertures.
- Understand and apply the laws of reflection and refraction.
- Use ray tracing and the thin-lens equation to analyze image formation by lenses and mirrors.
- Understand image formation by various optical instruments such as cameras, microscopes and telescopes; understand apparent size and how a magnifier works; recognize that diffraction limits the resolution of optical systems.
- Understand the eye, focusing and accommodation, and the use of lenses in correcting near- and farsightedness.

Major Course Content

1. RAY OPTICS
   a. The Ray Model
   b. Reflection

   c. Refraction
   d. Image formation
      i. Mirrors & Lenses
      ii. Plane Mirrors
      iii. Spherical Mirrors
      iv. Thin Lenses
   e. Color & Dispersion
   f. Optical Instruments
      i. Magnification
      ii. Resolution/Resolving Power
2. CHARGE AND MATTER
   a. Charge Model
   b. Conductors and Insulators
   c. Coulomb's Law
3. ELECTRIC FIELDS
   a. Electric Field Model
   b. Applications of Electric Fields
   c. Conductors & Electric Fields
   d. Forces & Torques in Electric Fields
4. ELECTRIC POTENTIAL
   a. Electric Potential Energy
   b. The Electric Potential
      i. Point Charges
      ii. Parallel Plate Capacitor
   c. Relationship between Electric Potential and Electric Field
   d. Capacitors & Dielectrics
      i. Capacitance
      ii. Energy Stored in a Capacitor
5. CURRENT & RESISTANCE
   a. Model of Current
   b. Batteries & emf
   c. Conductivity & Resistivity
   d. Resistance & Ohm's Law
6. CIRCUIT FUNDAMENTALS
   a. Circuit Elements & Diagrams
   b. Kirchoff's Laws
   c. Series & Parallel Circuits
   d. Energy & Power
   e. RC Circuits
7. MAGNETISM
   a. Magnetic Field
   b. Magnetic Force
   c. Ampere's Law
   d. Biot-Savart Law
   e. Forces & Torques on Current Loops
   f. Magnetic Properties of Matter
8. ELECTROMAGNETIC INDUCTION
   a. Induced Currents
   b. Motional emf
   c. Magnetic Flux
   d. Lenz's Law
   e. Faraday's Law
   f. Induced Fields
9. ELECTROMAGNETIC FIELDS AND WAVES
   a. Properties of EM Waves
   b. Photon Model of EM waves
   c. The EM Spectrum
10. AC CIRCUITS
   a. Transformers
   b. Capacitor Circuits
   c. Inductors & Inductor Circuits
   d. Oscillation Circuits
   e. Applications of AC Circuits
11. QUANTUM MECHANICS
   a. Experimental Foundation of Modern Physics
   b. Structure of Matter
      i. X-ray Diffraction
   c. Matter Waves & Energy Quantization
   d. Wave Functions
   e. Heisenberg Uncertainty Principle
   f. Applications & Implications of Quantum Mechanics
      i. Quantum Models
      ii. Quantum Mechanical Tunneling
12. ATOMIC PHYSICS
   a. The Hydrogen Atom
   b. The Bohr Model
   c. The Quantum Mechanical Model
   d. Multi-electron Atoms & the Periodic Table of Elements
   e. Spectroscopy
      i. Excited States & Spectra
      ii. Photons & Energy Quantization
   f. Stimulated Emission & Lasers
13. NUCLEAR PHYSICS
   a. Nuclear Structure
   b. The Strong Force
   c. The Shell Model
   d. Radiation & Radioactivity
      i. Nuclear Decay Mechanisms
      ii. Half-life
   e. Applications of Nuclear Physics

Lab Content

1. Thin lenses
2. Optical Instruments
3. The Human Eye
4. Electrostatics
5. Electric Fields & Equipotentials
6. The Parallel Plate Capacitor
7. Resistivity
8. Circuits
9. Magnetic Fields
10. Spectroscopy
11. Computed Tomography (CT)
12. Radioactive Decay

Examples of Required Writing Assignments

Written responses to short answer questions on homework, labs and exams and written lab journal entries.

Examples of Outside Assignments

Complete online learning modules.
Answer conceptual questions such as: "Would the resistivity of thick nerves be greater than, less than or equal to the resistivity of thin nerves? Explain."
Solve quantitative problems such as "An object is 10mm from the objective of a certain compound microscope. The lenses are 300mm apart and the intermediate image is 50mm from the eyepiece. What overall magnification is produced by the instrument?"

Instruction Type(s)

Lecture, Lab, Online Education Lecture, Online Education Lab

IGETC Area 5: Physical and Biological Sciences

5A. Physical Science, 5C. Science Laboratory