

Course Outline
PHS/PLA 302 College Physics II
May 2011

Department: Chemistry and Physical Sciences

Credit Hours: 5

Prerequisites: PHS/PLA 301. Students must register for PLA 302 lab and PHS 302 problem solving/quiz session.

General Education: 7.1 Scientific Literacy

Learning Outcomes: I.C, II.B, II.D

I. Course Description:

Continues the topics of PHS/PLA 301, includes an in-depth, mathematically-based presentation of physics, emphasizing physical principles, problem solving, and laboratory experiences. Involves a study of electricity, magnetism, waves, and sound. Three hour lecture, three hour lab, one hour problem solving and quiz session.

II. Purpose of the Course:

To provide a solid physics foundation for students who are pursuing technical and professional studies for careers or higher level courses in physics.

III. Learning Outcomes and Objectives:

L.O. I. Knowledge of Human Cultures and the Physical and Natural World–

Students will engage the big questions, both contemporary and enduring, and gain an understanding of the diversity of human experience and the physical and natural world in order to become well-educated citizens in a global society.

They can:

- C. Use knowledge and the methods of inquiry and analysis appropriate to physical or natural sciences, the social sciences, and mathematics to develop well reasoned solutions to local and global issues.

L.O. II. Intellectual and Practical Skills

Students will frame meaningful questions and to answer them will gather pertinent information using appropriate technological tools. They will analyze, synthesize and reflect on that information and effectively apply and communicate the results.

They can:

- B. Comprehensively and objectively analyze and evaluate appropriate data (e.g., issues, texts, artifacts, and events) in order to develop an informed conclusion.
- D. Use mathematical or formal reasoning to answer questions or to achieve desired goals.

IV. General Objectives:

1. Organize, reinforce, and extend the important concepts of physics. (L.O. IC, IIB, IID)
2. Use the language of physics with reasonable competence. (L.O. IC, IIB)
3. Solve physics problems with reasonable skill. (L.O. IC, IIB, IID)
4. Use techniques and procedures in the laboratory to gain experience with physical investigations. (L.O. IC, IIB, IID)
5. Recognize and use a broad range of physical applications in the real world. (L.O. IC, IIB, IID)
6. Explain natural phenomena with the laws of physics, revealing their underlying beauty and simplicity. (L.O. IC, IIB, IID)
7. Describe interrelationships between physics and other sciences, and the work and activities of practicing scientist in these fields. (L.O. IC, IIB, IID)
8. Communicate orally and in writing the important ideas of physics. (L.O. IC, IIB, IID)

V. Topical Outline

I. Wave Motion

- A. Mechanical Waves
- B. Types of Waves
- C. Speed of Waves
- D. Periodic Wave Motion
- E. Energy in a Periodic Wave
- F. Superposition Principle
- G. Standing Waves
- H. Characteristic Frequencies

II. Sound

- A. Production of Sound
- B. Speed of Sound
- C. Vibrating Columns of Air
- D. Resonance
- E. Audible Sound Waves
- F. Pitch and Quality
- G. Interference and Beats
- H. Doppler Effect

III. Light and Illumination

- A. The Nature of Light
 - 1. particles of light
 - 2. light as a wave
- B. Propagation of Light
- C. Electromagnetic Spectrum
- D. Quantum Theory
- E. The Speed of Light
- F. Light Rays and Shadows
- G. Luminous Flux
- H. Luminous Intensity
- I. Illumination

IV. Reflection and Mirrors

- A. Laws of Reflection
- B. Plane Mirrors
- C. Spherical Mirrors
- D. The Nature of Images
- E. Mirror Equation
- F. Magnification
- G. Spherical Aberration

V. Refraction

- A. Index of Refraction
- B. Laws of Refraction
- C. Wavelength and Refraction
- D. Dispersion
- E. Total Internal Reflection
- F. Apparent Depth

VI. Lenses

- A. Simple Lenses
- B. Focal Length
- C. Lensmaker's Equation
- D. Image formed by Thin Lens
- E. Lens Equation and Magnification

- F. Combination of Lenses
 - 1. Microscopes
 - 2. Telescopes
- G. Lens Aberrations

- VII. Interference, Diffraction, and Polarization
 - A. Diffraction
 - B. Interference
 - C. Diffraction Grating
 - D. Resolving Power
 - E. Polarization

- VIII. The Electric Force
 - A. Electric Charge
 - B. The Electron
 - C. Insulators, Conductors and Semi-conductors
 - D. Electroscopes
 - E. Redistribution of Charge
 - F. Charging by Induction
 - G. Coulomb's Law

- IX. Electric Field
 - A. Definition of a Field
 - B. Intensity
 - C. Field Lines
 - D. Gauss's Law
 - 1. Applications

- X. Electric Potential
 - A. Potential Energy
 - B. Potential
 - C. Differences in Potential
 - D. Millikan's Experiment
 - E. Electron volts

- XI. Capacitance
 - A. Limits on Charging Capacitors
 - B. Computing Capacitance
 - C. Dielectric Constants
 - D. Capacitors in Circuits

- XII. Current and Resistance
 - A. The Motion of Charge
 - B. Direct of Current
 - C. Electromotive Force
 - D. Ohm's Law
 - E. Electric Power and Heat Loss
 - F. Resistivity
 - G. Effect of Temperature on Resistance

- XIII. Direct Current Circuits
 - A. Resistors in Series and Parallel
 - B. EMF and Terminal Potential
 - C. Measuring Internal Resistance
 - D. Reversing Current Through an EMF Source
 - E. Whetstone Bridge

- XIV. Magnetism and Magnetic Fields
 - A. Magnetism
 - B. Magnetic Fields
 - C. Theory of Magnetism
 - D. Flux Density and Permeability
 - E. Magnetic Field and Electric Current
 - F. Force on a Moving Charge
 - G. Forces on a Current Carrying Wire
 - H. Magnetic Field of a Long Straight Wire
 - I. Other Magnetic Fields

- XV. Forces and Torques in a Magnetic Field
 - A. Force and Torque on a Loop
 - B. Magnetic Torque on a Solenoid
 - C. Galvanometers
 - D. DC Voltmeters
 - E. DC Ammeter
 - F. DC Motor

- XVI. Electromagnetic Induction
 - A. Faraday's Law
 - B.. EMF Induced in a Moving Wire
 - C. Lenz's Law
 - D. AC Generator
 - E. DC Generator
 - F. Back EMF in a Motor
 - G. Transformers

- XVII. Alternating Current Circuits
 - A. Capacitors
 - B. Inductors
 - C. Alternating Currents
 - D. Phase Relationships
 - E. Reactance
 - F. Series AC Circuits
 - G. Resonance
 - H. Power Factor

- XVIII. Modern Physics
 - A. Structure of Atoms
 - B. Quarks and Other "Strange" Particles
 - 1. Bosons and Mesons
 - D. Relativity
 - E. Quantum Mechanics
 - F. Quantum Chromodynamics
 - G. The Search for A Final Theory
 - 1. A Grand Unified Theory?
 - 2. A Theory of Everything?
 - 3. Superstrings
 - 4. Schrodinger's Cat and Unanswered Questions.