COURSE OUTLINE

PHYS-112

General Physics III (Calculus)

3 Credits

HOWARD COMMUNITY COLLEGE

Description

General Physics 112 is the final semester of a three-semester calculus-based physics course. The course will enable the student to solve problems, using calculus methods when applicable, for the major concepts in physics to include: wave motion; sound waves; superposition; standing waves; advanced electromagnetic wave theory including Maxwell's Equations; geometric and some physical optics; special theory of relativity; and topics in modern physics. In the laboratory/recitation program, the student will develop the ability to appraise, use and interpret data collected to express mathematically and/or explain the physical phenomena involved. Prerequisite: MATH-150 or MATH-182, and PHYS-111, and eligible to enroll in ENGL-121. (2 hours lecture, 3 hours lab).

Overall Course Objectives

Upon completion of this course, the student will be able to:

1. Discuss the physical properties and applications of wave motion and apply to solve problems.
2. Solve problems involving sound including the Doppler Effect.
3. Explain the superposition of waves and standing waves plus apply the concept to solve problems.
4. Discuss the significance of Maxwell's equations and use them to solve problems involving electromagnetic waves.
5. Explain the nature and properties of light.
6. Differentiate between reflection, refraction and total internal reflection.
7. Solve problems involving plane and spherical mirrors and thin lenses.
8. Describe Young's interference experiment.
9. Differentiate between interference, diffraction and polarization, and solve related problems.
10. Explain the Special Theory of Relativity, and solve problems involving time dilation and length contraction.
11. Compute relativistic momentum and energy.
12. Discuss black body radiation and calculate frequencies of light involved in the photoelectric effect.
13. Analyze atomic spectra and compute energy states of an atom.
14. Calculate the waves of a particle according to deBroglie.
15. Apply Heisenberg's uncertainty principle to estimate velocities and locations of electrons.
16. Discuss quantum mechanics and the exclusion principle to explain the location of elements in the periodic table.
17. Calculate the binding energy of atoms.
18. Determine the age of a carbon specimen by using carbon dating analysis.
19. Use laboratory equipment to measure variables, analyze data and deduce results of experiments in the field of thermodynamics, optics, spectroscopy and radioactivity.

Major Topics

I. Mechanical Waves
- A. Physical Properties and Applications of Wave Motion
- B. Sound including Doppler Effect
- C. Superposition and Standing Waves

II. Light and Optics
- A. Maxwell's Equations and Electromagnetic Waves
- B. Light (Nature, Measurement of Speed), Reflection and Refraction
- C. Dispersion (Prisms), Total Internal Reflection
- D. Plane Mirrors, Spherical Mirrors
- E. Thin Lenses
- F. Camera, Eye, Simple Magnifier, Microscope and Telescope
- G. Interference, Young's Double-Slit Experiment, Thin Films
- H. Single-Slit Diffraction, Diffraction Grating
- I. Polarization

III. Modern Physics
- A. Special Theory or Relativity
- B. Lorenz Transformations, Relativistic Momentum and Energy
- C. Blackbody Radiation and Planck's Hypothesis, Photoelectric Effect
- D. Compton Effect, Atomic Spectra, Bohr's Model of the Atom
- E. Wave Properties of Particles (deBroglie), Uncertainty Principle (Heisenberg)
- F. Quantum Mechanics, Schrodinger Equation
- G. Exclusion Principle, Periodic Table, Atomic Transitions
- H. Properties of Nuclei, Binding Energy
- I. Radioactivity (Marie Curie), Decay and Carbon Dating
- J. Nuclear Reactions

Course Requirements

Grading/exams: Grading procedures will be determined by the individual faculty member but will include the following:

Final grades will be based on homework, quizzes, unit tests, writing assignments and a final exam.

Writing: Specific writing assignments will be determined by the individual faculty member but will require at least 300 words. The writing assignments will deal with theoretical topics in physics and procedures for solving problems. In addition, writing will be required for the preparation of lab reports for all experiments.

Other Course Information

This course is an Arts and Sciences elective. This course is a Science elective.