C-ID Descriptor
Calculus-Based Physics for Scientists and Engineers: C

Descriptor Details

- **Descriptor Title**: Calculus-Based Physics for Scientists and Engineers: C
- **C-ID Number**: 215
- **Units**: 4.0
- **Hours**: 0000
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General Description

This course, intended for students majoring in physical sciences and engineering, is part of a three-semester course whose contents may be offered in other sequences or combinations. Core topics include optics and modern physics.

Prerequisites

C-ID PHYS 205 (prerequisite)

Corequisites

2 semesters college-level calculus (co-requisite) (C-ID MATH 210 and 220 OR MATH 211 and 221 OR MATH 900s)

Advisories

Completion of second semester calculus and concurrent enrollment in third semester calculus (if Physics 215 is taken before Physics 210).

Content

- Geometric Optics
- Lenses, Mirrors and Optical Instruments
- Wave Optics / Physical Optics
- Special Relativity
- Photoelectric Effect
- Heisenberg's Uncertainty Principle
- Schrödinger's Equation
- Bohr Model of Hydrogen
- Additional Optional Topics from Modern Physics
    - Atomic Physics
    - Condensed Matter/Solid State
    - Nuclear Physics
    - Particle Physics
- "Floating Topics" which may be included in this semester
    - Fluids
    - Simple Harmonic Motion
    - Mechanical Waves
    - Sound
    - Laws of Thermodynamics
    - Heat Engines
    - Kinetic Theory of Gases
    - Entropy
    - Properties of Electromagnetic Waves

Lab Activities

Laboratory activities should cover the range of topics designated for lecture. The majority of labs should be hands-on activities with "real-world" data collection as opposed to computer simulation, although simulations may be appropriate for some topics in modern physics.

Objectives

Lecture Course Objectives*: *At the conclusion of the lecture component of this course, the student should be able to:*

1. Analyze basic physical situations involving reflection and refraction, and use this analysis to predict the path of a light ray.
2. Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.
3. Apply concepts from special relativity to analyze physical situations, including time dilation, length contraction, and the Lorentz transformation. Solve basic problems involving relativistic momentum and energy.
4. Apply basic concepts of quantum mechanics to analyze basic physical setups, including a particle in a box and simple atomic models.

Laboratory Course Objectives*: *At the conclusion of the laboratory component of this course, the student should be able to:*

1. Analyze real-world experimental data, including appropriate use of units and significant figures.
2. Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.

*Note that course objectives are not limited to the ones listed here.

Evaluation Methods

Examinations which include problem solving exercises, final examinations, projects, homework problems, laboratory reports.

*Note that not all of the methods listed are required.

Textbooks

Typical Textbooks:

Giancoli, Douglas C. *Physics for Scientists and Engineers*

Halliday, David; Resnick, Robert; Walker, Jearl. *Fundamentals of Physics*

Knight, Randall D. *Physics for Scientists and Engineers: A Strategic Approach*

Serway, Raymond A.; Jewett, John W. *Physics for Scientists and Engineers*

Moebs, Willian; Ling,, Samuel J; Sanny, Jeff. *University Physics, Volume 3*

Typical Lab Manuals:

Edmonds, Jr., Dean S. *Cioffari's Experiments in College Physics*

Laws, Priscilla. *Workshop Physics Activity Guide, Module 3*

Loyd, David. *Physics Lab Manual*

Sokoloff, David, *Real Time Physics: Active Learning Laboratories, Module 4*

Laboratory manual developed on site