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

Descriptor Details

- **Descriptor Title**: Calculus-Based Physics for Scientists and Engineers: ABC
- **C-ID Number**: 200
- **Suffix**:
  - Sequence (S)
- **Units**: 12.0
- **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 an introduction to kinematics, dynamics, work and energy, momentum, gravitation, simple harmonic motion, electrostatics, magnetism, DC and AC circuits, Maxwell’s equations, optics and modern physics.

Prerequisites

No information provided

Corequisites

1 semester college-level calculus for PHYS 205 (co-requisite); 2 semesters college-level calculus for PHYS 210 (co-requisite)

Advisories

A year of high school physics or a physics prep course. Completion of 1 semester of calculus for Physics 205. For Physics 210 (or for Physics 215 if taken prior to Physics 210), completion of 2 semesters of calculus and concurrent enrollment in third semester calculus is highly recommended.

Content

No information provided

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. Predict the future trajectory of an object moving in two dimensions with uniform acceleration.
2. Analyze a physical situation with multiple constant forces acting on a point mass using Newtonian mechanics.
3. Analyze a physical situation with multiple forces acting on a point mass or extended object using concepts of work and energy.
4. Analyze simple static charge distributions and calculate the resulting electric field and electric potential.
5. Analyze simple current distributions and calculate the resulting magnetic field.
6. Predict the trajectory of charged particles in uniform electric and magnetic fields.
7. Analyze DC and AC circuits in terms of current, potential difference, and power dissipation for each element.
8. Analyze basic physical situations involving reflection and refraction, and use this analysis to predict the path of a light ray.

9. Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.
10. 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.
11. 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 error propagation, 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, Volumes 1 - 3*

Typical Lab Manuals:

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

Laws, Priscilla. *Workshop Physics Activity Guide, Modules 1 through 4*

Loyd, David. *Physics Lab Manual*

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

Laboratory manuals developed on-site