Course Outline

2026-2027 Catalog

PHYS 43 - Physics for Scientists and Engineers III

Catalog Description

Transfer Status: CSU/UC

Prerequisite: PHYS 41, MATH C2220

Unit(s): 4.00

Lecture: 51.00 Contact hours/102.00 Out of class hours/153.00 Total hours/3.00 Unit(s)
Lab: 51.00 Contact hours/0.00 Out of class hours/51.00 Total hours/1.00 Unit(s)
Total: 102.00 Contact hours/102.00 Out of class hours/204.00 Total hours/4.00 Unit(s)

Course 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. Graded only. (C-ID PHYS 215) (C-ID PHYS 200S = PHYS 41, PHYS 42, and PHYS 43).

Objectives

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

1. Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.
2. Apply basic concepts of quantum mechanics to analyze basic physical setups, including a particle in a box and simple atomic models.
3. Analyze real-world experimental data, including appropriate use of units and significant figures.
4. Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.
5. 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.
6. Analyze basic physical situations involving reflection and refraction, and use this analysis to predict the path of a light ray.

Course Content

Topic Titles / Suggested Time Topic

Lecture

Topics	Lec Hrs
Wave Optics / Physical Optics	3.00
Quantum Mechanics	9.00
Atomic Physics	5.00
Condensed Matter/Solid State	6.00
Nuclear Physics	3.00
Particle Physics	3.00
Mechanical Waves	3.00
Laws of Thermodynamics	5.00
Heat Engines	3.00
Kinetic Theory	3.00
Entropy	5.00
Geometrical Optics, Lenses, Mirrors, and Optical Instruments	3.00
Total Hours:	**51.00**

Lab

Topics	Lab Hrs
Wave Optics / Physical Optics	6.00
Quantum Mechanics	3.00
Atomic Physics	6.00
Condensed Matter/Solid State	3.00
Nuclear Physics	6.00
Particle Physics	6.00
Mechanical Waves	3.00
Laws of Thermodynamics	3.00
Heat Engines	3.00
Kinetic Theory	3.00

Topics	Lab Hrs
Entropy	3.00
Geometrical Optics, Lenses, Mirrors, and Optical Instruments	6.00
Total Hours:	**51.00**

Methods of Instruction

A. Demonstrations
B. Discussion
C. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
D. Laboratory Experiments
E. Lecture
F. Problem-Solving Sessions

Methods of Evaluation

A. Exams/Tests
B. Quizzes
C. Homework
D. Lab Projects
E. The evaluation of student progress will be accomplished through the use of written examinations, tests, quizzes, homework assignments, and a final examination., The evaluation of student laboratory progress will be through laboratory reports.

Examples of Assignments

Reading Assignments

1. Read the article "A short history of atomic physics in the twentieth century" and prepare to discuss the seminal experiments performed that elucidated the structure of the atom.
2. Read "Boltzmann's work in statistical physics". Prepare to participate in a discussion regarding connecting the macroscopic thermodynamics to the microscopic world of quantum mechanics.

Writing Assignments

1. Write a detailed report on the Frank-Hertz experiment including a one page introduction, a brief description of the apparatus, annotated data sheet, calculations and error analysis.
2. Produce a detailed solution of a quantum mechanical particle in a box. Include a summary relating standing waves on a string to the descreteness of the energy levels in this primitive model of the hydrogen atom and the connections to the spectrum of the Hydrogen atom.

Out-of-Class Assignments

1. Research the methods for doping in semiconducting materials. Be prepared to give a overview of the steps requred to fabricate a pn junction.
2. Practice the derivation of the ideal gas law using Newton's laws (Kinetic Theory). Prepare to reproduce the key steps of this derivation during a quiz.

Recommended Materials of Instruction

Halliday, D., Resnick, R., & Walker, J. (2021). Fundamentals of Physics Extended. *Wiley, 12th.* 9781119773511.

Other Learning Materials

Miscellaneous graph paper will be required for experimental write-ups.
A scientific calculator is recommended.

Minimum Qualifications

Physics/Astronomy (Masters Required)

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