Course Outline

2026-2027 Catalog

PHYS 42 - Physics for Scientists and Engineers II

Catalog Description

Transfer Status: CSU/UC

Prerequisite: PHYS 41, MATH C2220

Unit(s): 4.00

Lecture: 25.50 Contact hours/51.00 Out of class hours/76.50 Total hours/1.50 Unit(s)
Activity: 51.00 Contact hours/25.50 Out of class hours/76.50 Total hours/1.50 Unit(s)
Lab: 51.00 Contact hours/0.00 Out of class hours/51.00 Total hours/1.00 Unit(s)
Total: 127.50 Contact hours/76.50 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 electrostatics, magnetism, DC and AC circuits, and Maxwell's equations. Graded only. (C-ID PHYS 210/PHYS 200S).

Objectives

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

1. Analyze simple static charge distributions and calculate the resulting electric field and electric potential.
2. Analyze simple current distributions and calculate the resulting magnetic field.
3. Predict the trajectory of charged particles in uniform electric and magnetic fields.
4. Analyze DC and AC circuits in terms of current, potential difference, and power dissipation for each element.
5. Analyze basic physical situations involving reflection and refraction, and use this analysis to predict the path of a light ray.
6. Analyze real-world data, including appropriate use of units and significant figures.
7. Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.

Course Content

Topic Titles / Suggested Time Topic

Lecture/Activity

Topics	Lec Hrs	Act Hrs
Electrostatics	2.50	5.00
Fields	2.00	4.00
Potentials	2.00	4.00
Gauss’s Law	1.50	3.00
DC circuits	1.50	3.00
Capacitors	1.50	3.00
Resistivity	1.00	2.00
Magnetism	4.50	9.00
AC Circuits	2.50	5.00
Faraday’s and Lenz’s Laws	1.50	3.00
Ampere’s Law	1.00	2.00
Maxwell’s Equations	1.00	2.00
Properties of EM Waves	1.00	2.00
Physical Optics	1.00	2.00
Geometric Optics	1.00	2.00
Total Hours:	**25.50**	**51.00**

Lab

Topics	Lab Hrs
Electrostatics	6.00
Fields	3.00
Potentials	3.00
Gauss’s Law	6.00
DC circuits	3.00
Capacitors	3.00
Resistivity	3.00

Topics	Lab Hrs
Magnetism	3.00
AC Circuits	3.00
Faraday’s and Lenz’s Laws	3.00
Ampere’s Law	3.00
Maxwell’s Equations	3.00
Properties of EM Waves	3.00
Geometric Optics	3.00
Physical Optics	3.00
Total Hours:	**51.00**

Methods of Instruction

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

Methods of Evaluation

A. Lab Reports
B. Exams/Tests
C. Quizzes
D. Homework
E. Lab Projects

Examples of Assignments

Reading Assignments

1. Read through the example coulombs law problem. Be prepared to solve a similar problem in class.
2. Read Feynman's discussion of cargo cult science. Prepare to contrast the development of Maxwell's equations with other self described sciences.

Writing Assignments

1. Write an annotated and complete solution of the electric field around a uniformly charged thin rod. Include an analysis of the limiting behavior of the solution both near and far from the rod.
2. Write a thorough report on the determination of the magnetic field of the Earth. Include an introduction, a paragraph on historical measurements of the Earths magnetic field, annotated derivations of the underlying relationships used in the experiment and error analysis.

Out-of-Class Assignments

1. Look up the conductivity of silver, gold, copper and steel. Contrast this with glass, paper, plastic and wood. Be prepared to discuss the rough categorization of materials as conductors or insulators.
2. Calculate the energy usage per month from the lights in your house using the power ratings on the lights and estimates for the usage. Compare this with the total energy usage from your PG&E bill. (If you do not have access to such things use the house of a friend or parents.)

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)

Created/Revised by: Panunto, Michael
Date: 10/31/2022