PHYS 0110 - GENERAL PHYSICS II

Catalog Description

Formerly known as PHYS 2B (PHYS 110 and 110L, combined)
Prerequisite: Completion of PHYS 105 and 105L with grades of "C" or better
Corequisite: Concurrent enrollment in PHYS 110L
Hours: 72 lecture
Description: Noncalculus introduction to the principles of waves, sound, light, electricity, magnetism, and modern physics. Emphasis on applications relevant to several majors, including premedical, predental, optometry, forestry, architecture, and biological science. (combined with PHYS 110L, C-ID PHYS 110) (CSU, UC-with unit limitation)

Course Student Learning Outcomes

- CSLO #1: Solve problems associated with electricity, magnetism, and waves using trigonometry and algebra.
- CSLO #2: Identify which physical concepts associated with electricity, magnetism, and waves explain physical phenomena.
- CSLO #3: Develop an overlying and rigorous process to evaluate the behavior of physical systems involving electricity, magnetism and waves.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

144

Total Student Learning Hours

216

Course Objectives

A thorough understanding of physics requires the student to evaluate data and synthesize ideas to solve conceptual and numerical problems. The list of objectives below is intended to assist the student in this endeavor. Thus students in Physics 110 are expected to:
Vibrations and Waves:
The students will be able to
1. Identify Hooke's law and apply it to motion of masses attached to springs.
2. Solve problems involving systems with elastic potential energy.
3. Define simple harmonic motion.
4. Describe the equations of motion for a mass/spring system in conceptual and mathematical terms.
5. Apply the procedure for problem solving developed for the mass/spring system for the case of a simple pendulum.
6. Describe the effect of damping on a simple harmonic oscillator.
7. Define a wave in conceptual and mathematical terms.
8. Define the concepts of frequency, amplitude and wavelength and apply to the description of a wave.
9. Determine the physical characteristics that control the speed of a wave on a string.
10. Describe the effect of more than one wave traveling in a medium in terms of interference.
11. Describe wave reflection and the boundary condition(s) that will result in an inversion of the wave upon reflection.

Sound:
The students will be able to
1. Describe the characteristics of sound waves in terms of frequency.
2. Identify and explain the general physical characteristics that determine the speed of sound in a fluid and in a solid and solve problems for the speed of sound under varying circumstances.
3. Define intensity and intensity level and calculate how they vary with distance.
4. Describe the Doppler effect and apply the equations to solve for changes in wavelength and frequency of a wave as the motion of the observer and/or source change.
5. Apply the principle of interference to sound waves to explain the variation in loudness relative to the position with respect to two sources.
6. Describe the circumstances that lead to standing waves. Be able to sketch the first several harmonics of standing waves on strings and in air columns under varying boundary conditions. Solve problems involving standing waves.
7. Describe forced vibrations and resonance.
8. Use the principle of interference to describe the phenomena of beats. Be able to calculate the beat frequency.
9. Describe sound quality and how it determines the tones coming from musical instruments.
10. Describe how the ear interacts with a sound wave to produce sound. Specifically, be able to describe the structures of the ear that are involved in transforming a wave into the physiological phenomena of sound.

Electric Forces and Fields:
The students will be able to
1. Describe and explain the following physical properties of charge:
a. Positive and negative charges and their origin
b. Forces of attraction and repulsion between charges
c. Charging by induction and conduction
d. Insulators and conductors.
2. Describe and explain all of the relevant parameters of Coulomb's Law and apply to solving problems involving the forces between point charges.
3. Describe and explain an electric field and be able to calculate the field due to a collection of point charges.
4. Use electric fields to calculate the force on a point charge.
5. Define and explain the rules for electric field lines.
6. Draw electric field lines for simple charge distributions.
7. Describe and explain the properties of conductors in electrostatic equilibrium.
8. Describe and explain how the Van de Graff generator works.

Electrical Energy and Capacitance:
The students will be able to
1. Define and explain electric potential and potential difference and be able to calculate the electric potential due to a distribution of point charges.
2. Describe and explain the electric potential of charged conductors in qualitative and quantitative terms.

3. Solve problems involving electrical potentials, electrical potential energy and conservation of energy.
4. Explain the concept of equipotential surfaces and apply it to describe and explain charge distributions in conductors.
5. Define capacitance and calculate the capacitance for a parallel plate capacitor.
6. Determine the equivalent capacitance for capacitors connected in series and/or parallel.
7. Determine the amount of energy stored in capacitors.
8. Explain the effect a dielectric has on the capacitance and calculate the increase in capacitance given the dielectric constant.

Electric Current:
The students will be able to
1. Define electric current and conceptually understand the microscopic model of electron flow.
2. Measure the current in circuits and the voltages across the elements in the circuit.
3. Define and explain resistance, resistivity and what is meant by Ohm's Law.

Direct Current (DC) Circuits:
The students will be able to
1. Describe and explain sources of emf.
2. Calculate the equivalent resistance for parallel and series connections of resistors.
3. Describe and explain Kirchoff's rules.
4. Analyze and explain the behavior of RC circuits.

Magnetism:
The students will be able to
1. Describe and explain magnets and magnetic fields.
2. Solve problems involving magnetic forces on current carrying conductors.
3. Describe, explain and calculate the torque on a current loop and use to explain the electric motor.
4. Describe, explain, and calculate the magnetic field due to a long straight wire, current loops, and solenoids.
5. Describe and explain Ampere's Law.
6. Calculate the magnetic force between parallel conductors.

Induced Voltages and Inductance:
The students will be able to
1. Describe and explain:
a. Induced electromotive force (emf) and magnetic flux
b. Faraday's Law of induction
c. Motional emf
d. Lenz's Law.
2. Apply the concepts Faraday's law and Lenz's law to calculate the induced emf for different circumstances, and to describe and explain the behavior of a generator.
3. Describe and explain self inductance.
4. Describe and explain the behavior of RL circuits.
5. Describe and explain the energy stored in a magnetic field.

Alternating Current (AC) Circuits:
The students will be able to
1. Describe and explain in a qualitative way:
a. the behavior of resistors, inductors and capacitors in an AC circuit
b. resonance.
2. Describe and explain the transformer and calculate the current and voltages across the primary and/or secondary terminals.
3. Describe and explain in a qualitative way an electromagnetic wave.

Reflection and Refraction:
The students will be able to
1. Describe and explain:
a. the nature of light
b. reflection and refraction
c. the law of refraction
d. dispersion and prisms.
2. Use Snell's Law to calculate the path followed by light traveling from one medium to another.
3. Use the concepts of the nature of light, the laws of reflection and refraction and dispersion to explain the characteristics of a rainbow.
4. Describe and explain total internal reflection.
5. Calculate the critical angle for total internal reflection.

Mirrors and Lenses:
The students will be able to
1. Describe and explain image formation for plane, spherical, and convex mirrors using the law of reflection and ray tracing.
2. Describe and explain images formed due to refraction.
3. Use ray tracing and the thin lens approximation to locate and describe images formed by thin lenses.

Wave Optics:
The students will be able to
1. Use the principle of interference to describe and explain Young's Double Slit experiment.
2. Describe and explain phase changes due to reflection.
3. Describe and explain thin film interference.
4. Describe and explain diffraction, single slit diffraction, and the diffraction grating.
5. Describe and explain polarization and the variety of ways to achieve it.

Optical Instruments:
The students will be able to
1. Describe and explain selected of the following:
a. The simple magnifier
b. The compound microscope
c. The camera
d. The telescope
e. The eye
f. The Michelson interferometer
g. Resolution of single slit or circular apertures.

Modern Physics:
The students will be able to
1. Distinguish between the physical aspects of classical physics and modern physics.
2. Describe and explain selected topics in modern physics.

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Physical Sciences
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B1 Physical Science
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 5A Physical Science

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: An audience response system will be used to assess the discussion portion of the course. Students discuss their reasoning for their response with their peers. The results of each student's response will count toward their class participation grade. An electron moving to the right enters a region of uniform magnetic field directed into the plane of the page. What is the direction of the force on the electron? A. Toward the top of the page. B. Toward the bottom of the page. C. Out of the plane of the page. D. Toward the left. E. There is no force because the magnetic field is uniform. Individual students will be graded based on the following two criteria: 1. Is the student participating in the discussion? 2. Did the student get the correct response? Based on how well the class responds to the question, the instructor will ask additional questions on this topic, review this topic, or move on to the next topic.
- Objective Examinations
  - Example: Chapter quizzes, audience response questions, homework, and unit exams along with a comprehensive final examination are used to measure student performance in terms of the stated performance objectives. Objective Exam: 1. An uncharged conductor is supported by an insulating stand. You hold a positively charged rod near the left end of the conductor, but do not touch it. The right end of the conductor will be: a. negative b. positive c. neutral d. attracted
- Problem Solving Examinations
  - Example: Two point charges are placed along a horizontal axis with the following values and positions: +3 nC at x = 0 cm and 7 nC at x = 20 cm. What is the net electric field (in N/C) at x = -10 cm? (let the positive direction be to the right).

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. A multimedia slide presentation is used to present the topic of Coulombs law in detail utilizing graphics and video segments for emphasis and clarity. Example problems are demonstrated by the instructor at appropriate times throughout the class lecture or live/recorded video. Students are always encouraged to ask questions in class or in the LMS video chat throughout the presentation. (Objectives: Electric Forces and Field 2).
2. Several live or video demonstrations of electric circuits using actual equipment at appropriate times during the presentation provide more emphasis and clarity. Students are also given a complete set of lecture notes in advance and encouraged to ask questions throughout the presentation in class or through LMS chat feature. (Objective: Direct Current Circuits 1,2).

Distance Learning

1. An audience response system is used to ask questions on the magnetic forces in order to assess the level of student understanding during lecture and recitation (problem solving session). Based on how well students respond to the questions, the instructor will ask additional questions on this topic, review this topic, or move on to the next topic. In the online format polling software will be used to administer the question for during live/recorded video sessions. (Objectives: Magnetism 2,6).
2. In class, group problem solving activities are administered to assess student understanding. The activities are also designed to get students to verbalize physical concepts to each member in the group, identify concepts that affect a physical system, and to illustrate how to build physical models. The instructor's role is to facilitate the activity. In the online modality this can be accomplished asynchronously using virtual groups or synchronously using a breakout groups feature of a live meeting software. Example: Four equal charges, q=
3. 03microC, of mass m=
4. 03microkg are at the corner of a square of side L=
5. 0289m. The top and the bottom side of the square are horizontal. If a particle of equal mass and charge is placed at the midpoint of one of the side of the square, what is its speed after moving a distance L/2? (Objectives: Electrical Energy and Capacitance 3)

Typical Out of Class Assignments

Reading Assignments

1. Read textbook chapter covering electric fields. Be prepared to answer questions with an audience response system in class. 2. Read textbook chapter covering magnetism. Be prepared to answer questions with an audience response system in class.

Writing, Problem Solving or Performance

1. Complete online homework assignment on electric fields. This is an assignment created by the instructor using an online homework service that accompanies the course textbook. Sample Problem: A small object of mass 3.80 g floats in a uniform electric field. What is the magnitude and direction of the electric field? 2. Complete problem solving worksheet on magnetic fields. Example: Calculate the force on a 1 meter long wire carrying current of 1 amp in a magnetic field of 1 Tesla.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- College Physics
  - Author: Serway and Vuille
  - Publisher: Cengage
  - Publication Date: 2018
  - Text Edition: 11th
  - Classic Textbook?:
  - OER Link:
  - OER:
- College Physics
  - Author: Paul Peter Urone and Roger Hinrichs
  - Publisher: OpenStax

- Publication Date: 2020
- Text Edition: 2nd
- Classic Textbook?:
- OER Link:
- OER:

Other materials and-or supplies required of students that contribute to the cost of the course.