PHYS 0210R - PROBLEM SOLVING FOR PHYSICS 210

Catalog Description

Formerly known as PHYS 4Y
Corequisite: Concurrent enrollment in PHYS 210
Hours: 18 lecture
Description: Optional problem solving course to accompany PHYS 210. Includes electric forces and fields, electrical potential, capacitors and dielectrics, magnetism, electromagnetic waves, and DC and AC circuits. (CSU, UC-with unit limitation)

Course Student Learning Outcomes

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

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

18

Outside of Class Hours

36

Total Student Learning Hours

54

Course Objectives

Student will accomplish the following utilizing content from Physics 210:
1. Identify the basic concepts affecting a physical system, by using a diagram, a graph, a list, or an equation.
2. Build a conceptual model of a physical system and explain the system using the model in a written or oral format.
3. Apply the proper mathematical (algebra, trigonometry, calculus) techniques to solve basic problems in physics.
4. Develop a set of rules or strategies for problem solving that may be applied to solve a new set of problems.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: The class is divided into small groups to solve a problem illustrating problem solving techniques required to complete Physics 210 homework assignments. Evaluation of problem solutions will take place by oral presentation to the instructor or the class. They can also be evaluated through solutions turned in at the end of class. Evaluations will be based on a rubric that reflects the problem solving skills reflected in several or all of the course objectives. Alternatively the evaluation may be based on participation. Sample Problem: Describe the physical meaning of each term in the Biot-Savart Law, and use it to calculate the magnetic field a distance d above the center of a circular filamentary current of radius R.
- Skill Demonstrations
  - Example: Students are asked to develop solutions to an assigned problem for presentation to the class. The presentation is evaluated on the basis of problems solving strategy and correctness. Sample Problem: Calculate the electric potential inside a uniformly charged sphere of radius R.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. A brief presentation on effective strategies for solving (conceptual and numerical) problems involving Gauss's Law is provided. The instructor solves an example problem in great detail. Students are then asked to discuss relevant concepts and problem solving strategies needed to solve Physics 210 homework assignments.
2. The instructor facilitates in class group problem activities to develop analytical skills and 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.

Distance Learning

1. The instructor uses a slide presentation or a live/recorded video session (with closed captioning) to highlight the process for calculating magnetic fields due to current carrying wires using the Biot-Savart law. If the presentation is synchronous, the instructor uses break out rooms and the polling feature in the LMS video conferencing software to ask multiple-choice questions that highlight the intricacies of the process. The instructor reviews the responses and possibly provides some prodding or explanation. Then students discuss their reasoning for their response with their peers and commit to the same or a different response. The instructor reviews the responses again and repeats the process as needed. Once the questioning is completed, the instructor will have students apply the process to a specific geometric configuration. As students

work on the problem, the instructor facilitates the problem solving process. If the presentation is asynchronous, students are prompted to answer questions on the intricacies of the process via discussion board. In this case, questions will be more open ended in nature rather than multiple-choice. A worksheet will also be assigned where students are required to apply the process to a specific geometric configuration. The students will work on the worksheet in virtual groups. The completed worksheet will be submitted via LMS

Typical Out of Class Assignments

Reading Assignments

1. Read the example problems on Coulomb's Law in the textbook. Be prepared to participate in class discussion. 2. Read and study the handout on the derivation of the expression for the electric field due to a dipole. Be prepared to discuss the approximation method that was used in the example.

Writing, Problem Solving or Performance

1. Prepare for presentation to the class a detailed solution to the following problem: A slab of insulating material has thickness 2d and is oriented so that its faces are parallel to the yz-plane and given by the planes x=d and x=-d. The y- and z-dimensions of the slab are very large compared to d and may be treated as essentially infinite. The slab has a uniform positive charge density r. a. Using Gauss's law, find the magnitude of the electric field due to the slab at the points 0≤x≤d. b. What is the direction of the electric field due to the slab at the points 0≤x≤d? c. Using Gauss's law, find the magnitude of the electric field due to the slab at the points x≥d. d. What is the direction of the electric field due to the slab at the points x≥d? 2. Complete the homework on Faraday's law for Physics 210. Document the strategies that were required to solve each problem. Be prepared to present discuss your problem-solving strategies in class.

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

Required Materials

- University Physics - Technology Update
  - Author: Young and Freedman
  - Publisher: Pearson
  - Publication Date: 2020
  - Text Edition: 15th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Physics for Scientists and Engineers - Technology Update
  - Author: Serway and Jewitt
  - Publisher: Cengage
  - Publication Date: 2019
  - Text Edition: 10th
  - Classic Textbook?:
  - OER Link:
  - OER:

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