Number: PHYS G280  
TITLE: Calculus Based Physics: Electricity/Magnetism

ORIGINATOR: James Almy  
EFF TERM: Fall 2014

FORMERLY KNOWN AS:  
DATE OF OUTLINE/REVIEW: 05-08-2014

CROSS LISTED COURSE:  
TOP NO: 1902.00

CID: PHYS 210

SEMESTER UNITS: 4.0

HRS LEC: 54.0  
HRS LAB: 54.0  
HRS OTHER: 0.0

CONTACT HRS TOTAL: 108.0

STUDY NON-CONTACT HRS RECOMMENDED: 108.0

CATALOG DESCRIPTION:
This is a calculus based physics course which covers the topics of electric charge, electric fields, potential dielectrics, DC circuits, magnetic fields, magnetic forces, electromagnetic induction, electromagnetic oscillators, and waves. UC Credit Limitations: Physics G120, G125 and G185, G280, G285 combined--maximum credit, one series; deduct credit for duplications of topics. C-ID: PHYS 210

JUSTIFICATION FOR COURSE:

PREREQUISITES:
- PHYS G185: Calculus Based Physics: Mechanics with a minimum grade of C or better
- PHYS A185: Calculus Based Physics: Mechanics with a minimum grade of C or better
  or
- MATH G185: Calculus 2 with a minimum grade of C or better
  and
- MATH A185: Calculus 2 with a minimum grade of C or better
  or
- MATH C185: Calculus 2 with a minimum grade of C or better
  or
- MATH A185H: Calculus 2 Honors with a minimum grade of C or better
  or
- MATH A182H: Calculus 1 and 2 Honors with a minimum grade of C or better
  or

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:
Physics/Astronomy

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00

CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]

GRADING POLICY: Pass/No Pass [ ] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]

OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]

TRANSFER STATUS: CSU Transferable[ ] UC/CSU Transferable[X] Not Transferable[ ]

BASIC SKILLS STATUS: Yes [ ] No [X]  
LEVELS BELOW TRANSFER: Not Applicable

CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable

NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course

OCCUPATIONAL (SAM) CODE: E
PHYS G280-Calculus Based Physics: Electricity/Magnetism

REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS: 

REQUIRED FOR DEGREE OR CERTIFICATE: No [ ] Yes [X]
Liberal Arts: Emphasis in Science(Associate in Arts)
Physics(Associate in Arts)

GE AND TRANSFER REQUIREMENTS MET:
IGETC Area 5: Physical and Biological Sciences
   5A: Physical Science
CSU GE Area B: Scientific Inquiry and Quantitative Reasoning
   B1 - Physical Science
   B3 - Laboratory Sciences

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. solve problems involving magnetic fields using calculus.
2. solve problems involving electromagnetic induction and Faraday's Law using calculus.
3. solve problems involving Maxwell's equations using calculus.
4. solve problems involving electromagnetic theory using calculus.
5. solve problems involving circuit theory using calculus.
6. demonstrate understanding of the basic concepts involved in estimating experimental uncertainties and performing an error analysis, including propagation of error for actual experimental data collected in lab.
7. use various electrical meters, including ammeters, voltmeters, ohmeters, and the oscilloscope, to make electrical measurements.
8. employ simple wiring techniques to construct electrical circuits using resistors, capacitors, and inductors for both DC and AC circuits from circuit diagrams.
9. construct an accurate record of laboratory work in a notebook and extract information from that record to write a lab report, just as experimental scientists do when reporting results to a journal for publication.

COURSE OBJECTIVES:
1. solve problems involving electromagnetic theory using calculus.
2. solve problems involving circuit theory using calculus.
3. solve problems involving magnetic fields using calculus.
4. solve problems involving electromagnetic induction and Faraday's Law using calculus.
5. solve problems involving Maxwell's equations using calculus.
6. collect data with appropriate sensors and meters to the appropriate significant figures.
7. analyze data in graphical form and based on theoretical equations.
8. perform statistical error analysis and a propagation of error analysis.
9. perform experiments involving the measurement of capacitance and resistance (RC circuits).
10. perform experiments involving resistance, current, and voltage (Ohm's Law and Kirchhoff's Laws, and Wheatstone Bridge circuit).
11. perform experiments involving the measurement of the magnetic field of a solenoid.
12. perform experiments involving the measurement of AC circuits using AC meters and an oscilloscope.
13. construct voltmeters and ammeters from galvanometers.

COURSE CONTENT:
LECTURE CONTENT:

A. Electrostatics
   1. Charge: Coulomb's law
   2. Electric field
      a. Line of force
      b. Field strength
      c. Gauss's law
   3. Electric potential :
   4. Capacitors and .dielectrics
B. Current electricity
   1. Current
      a. Resistance, emf
      b. Ohm’s law
   2. Circuits
C. Electromagnetism
   1. Magnetic fields
      a. Field near conductors
         i. Amperes law
         ii. Biot-Savast's law
      b. Force on a current
         i. Hall effect
         ii. Induction
            a. Faraday's law
            b. Lenz's law
            c. Inductance
      c. Magnetic materials
      d. Electromagnetic oscillators
         i. L C oscillators
         ii. Forced oscillation and resonance
         iii. Maxwell's equations
         iv. Electromagnetic waves
         v. Poynting vector

LABORATORY CONTENT:

A. Collect data with appropriate sensors and meters to the appropriate significant figures.
B. Analyze data in graphical form and based on theoretical equations.
C. Perform statistical error analysis and propagation of error analysis.
D. Perform experiments involving the measurement of capacitance and resistance (RC circuits).
E. Perform experiments involving resistance, current, and voltage (Ohm's Law and Kirchhoff's Laws, and Wheatstone Bridge circuit).
F. Perform experiments involving the measurement of the magnetic field of a solenoid.
G. Perform experiments involving the measurement of AC circuits using AC meters and an oscilloscope.
H. Construct voltmeters and ammeters from galvanometers.

METHODS OF INSTRUCTION:

A. Lecture:
B. Lab:
C. Independent Study:

INSTRUCTIONAL TECHNIQUES:
COURSE ASSIGNMENTS:
Reading Assignments

Textbook

Out-of-class Assignments

None required

Writing Assignments

Regular homework assignments are given which stress problem solving ability, and exams are given which test the students ability to solve such problems. The laboratory portion of the course is designed to give the student practice in making measurements and using equipment, and proficiency is determined by lab exams in which the student is expected to demonstrate the ability to use a piece of equipment to the instructor. In addition, students are expected to maintain lab notebooks which contain calculations and an analysis of each experiment.

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Problem Solving Exercises

Demonstration of Critical Thinking:

Students will demonstrate the ability to think critically by analyzing given physical situations (reading word problems and interpreting them), applying the basic laws of physics toward the solution of such problems, deducing valid conclusions from their results, and then explaining these results in terms of non-mathematical ideas. From data collected in the lab, the students will be able to verify and "discover" the basic laws of physics, and use graphs to predict the results of other experiments. The student will then take these ideas and write a lab report which describes the results of his work, as well as answering questions related to the performance of the experiment.

Required Writing, Problem Solving, Skills Demonstration:

Regular homework assignments are given which stress problem solving ability, and exams are given which test the students ability to solve such problems. The laboratory portion of the course is designed to give the student practice in making measurements and using equipment, and proficiency is determined by lab exams in which the student is expected to demonstrate the ability to use a piece of equipment to the instructor. In addition, students are expected to maintain lab notebooks which contain calculations and an analysis of each experiment.

TEXTS, READINGS, AND RESOURCES:

TextBooks:

Other:
1. Scientific or graphing calculator

LIBRARY:

Adequate library resources include:

Comments:

Attachments:

Attached Files