

PHYS A280: CALCULUS-BASED PHYSICS: ELECTRICITY/MAGNETISM WITH LAB

Item	Value
Curriculum Committee Approval Date	09/18/2024
Top Code	190200 - Physics, General
Units	5 Total Units
Hours	126 Total Hours (Lecture Hours 72; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)
Associate Arts Local General Education (GE)	<ul style="list-style-type: none"> Area 5 Physical and Biological Sciences, Scientific Inquiry, Life Science (OB)
Associate Science Local General Education (GE)	<ul style="list-style-type: none"> Area 5 Physical and Biological Sciences, Scientific Inquiry, Life (OSB)
California General Education Transfer Curriculum (Cal-GETC)	<ul style="list-style-type: none"> Cal-GETC 5A Physical Science (5A) Cal-GETC 5C Laboratory Activity (5C)
Intersegmental General Education Transfer Curriculum (IGETC)	<ul style="list-style-type: none"> IGETC 5A Physical Science (5A) IGETC 5C Laboratory Activity (5C)
California State University General Education Breadth (CSU GE-Breadth)	<ul style="list-style-type: none"> CSU B1 Physical Science (B1) CSU B3 Laboratory Activity (B3)

Course Description

Formerly: Calculus-Based Physics: Electricity/Magnetism. Continuation of PHYS A185. Coulomb's law, electrostatics fields, conductors and insulators. Gauss's law and electromagnetic fields. Magnetic fields and Ampere's law. Faraday's law of induction and Maxwell's equations of electromagnetic fields. Electromagnetic energy transfer by means of cables, transmission lines and transparent media. PREREQUISITE: PHYS A185 or PHYS A185H; and MATH A182H, or MATH A180/MATH A180H and MATH A185/MATH A185H, or appropriate OCC placement. Transfer Credit: CSU; UC: Credit Limitation: PHYS A120, PHYS A125, PHYS A130, PHYS A135 and PHYS A185, PHYS A280, PHYS A285 combined: maximum credit, 1 series. C-ID: PHYS 210. C-ID: PHYS 210.

Course Level Student Learning Outcome(s)

1. State the basic principles of electromagnetism, define important scientific terms in these areas, and provide explanations of how they apply to real-world situations.
2. Use calculus, algebra, trigonometry, and conceptual reasoning towards the solution of problems involving electromagnetism.
3. Conduct experiments using standard scientific methods, evaluate the resulting data, and construct evidence-based conclusions in a written report.

Course Objectives

- 1. Analyze the electric and magnetic fields and electric potentials generated by systems of point charges, dipoles, continuous charge distributions, and currents.
- 2. Apply the concepts of fields and potentials towards the analysis of interactions between point charges, dipoles, continuous charge distributions, and currents.
- 3. Analyze DC and AC circuits consisting of combinations of voltage sources, resistors, capacitors, and inductors.
- 4. Relate electromagnetic induction and electromagnetic radiation to the interaction between electric and magnetic fields.
- 5. Conduct experiments to acquire and analyze real-world data, with appropriate use of measurements, units, significant figures, and error propagation.
- 6. Relate experimental data and results to the basic physical concepts of electromagnetism.

Lecture Content

Electrostatics Fields and Potentials Gauss's Law Capacitance and Dielectrics Current and Resistivity DC Circuits Magnetism Ampere's Law Electromagnetic Induction Faraday's Law AC Circuits Maxwell's Equations Electromagnetic Waves

Lab Content

Laboratory activities cover a range of topics directly related to the lecture portion of the class, with an emphasis on hands-on activities with real-world data collection and analysis, including appropriate use of measurements, units, and significant figures. Representative experiments include investigations of: Measurement and Error Propagation Statistics Oscilloscopes Coulomb's Law Gauss Law Ohm's Law Resistor Circuits RC Circuits Bar Magnets Ampere's Law Transformers RLC Circuits Wave Properties

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

Lectures with demonstrations as well as in-class activities and discussion engage students in core scientific concepts and problem-solving techniques. Assigned readings and homework reinforce conceptual understandings and improve problem-solving skills. Laboratory activities challenge students to critically examine and apply

their scientific knowledge and technical skills in a real-world setting. Written lab reports provide further opportunities to improve analytical and communication skills. Students are encouraged to interact with the instructor and each other through in-class discussions and activities, as well as within lab groups and during instructor office hours.

Reading Assignments

1.5 hours per week as assigned by the instructor from texts, online or library research, and/or instructor handouts

Writing Assignments

1.5 hours per week on written reports summarizing the weekly lab experiments that include appropriate use of scientific and technical vocabulary, as well as significant qualitative and quantitative analysis

Out-of-class Assignments

5 hours per week on assignments and test preparation emphasizing problem-solving and concept application

Demonstration of Critical Thinking

Successful completion of assigned exams and quizzes, homework, in-class discussions and activities, and lab reports

Required Writing, Problem Solving, Skills Demonstration

Students will compose written lab reports summarizing the weekly lab experiments that include appropriate use of scientific and technical vocabulary, as well as significant qualitative and quantitative analysis. Exams, quizzes, and homework will require critical application of problem-solving skills.

Eligible Disciplines

Physics/Astronomy: Master's degree in physics, astronomy, or astrophysics OR bachelor's degree in physics or astronomy AND master's degree in engineering, mathematics, meteorology, or geophysics OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Halliday, D., et al. Fundamentals of Physics, Extended, 12 ed. Wiley, 2021 2. Required Moebs, W., et al. University Physics Volume 2, ed. OpenStax, 2016 Rationale: Most recent edition of OER textbook

Manuals Resources

1. OCC Physics Department. PHYS A280 Laboratory Manual, Orange Coast College , 01-01-2024