PHYS A135: UNIVERSITY PHYSICS 2: ELECTRICITY/ MAGNETISM WITH LAB

Item	Value
Curriculum Committee Approval Date	11/13/2024
Top Code	190200 - Physics, General
Units	4 Total Units
Hours	108 Total Hours (Lecture Hours 54; 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)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life Science (OB)
Associate Science Local General Education (GE)	• Area 5 Physical and Biological Sciences, Scientific Inquiry, Life (OSB)

Course Description

Formerly: University Physics 2 (non-majors). The second semester of a two-semester sequence with lab (PHYS A130/A135) covering a calculus-based study of all topics in basic physics. Core topics for this second semester include: electromagnetism, optics, and modern physics. PREREQUISITE: PHYS A130; and MATH A182H, MATH A185, or MATH A185H. 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.

Course Level Student Learning Outcome(s)

1. State the basic principles of electromagnetism, optics, and modern physics, define important scientific terms in these areas, and provide explanations of how they apply to real-world situations.
2. Apply calculus, algebra, trigonometry, and conceptual reasoning towards the solution of problems involving electromagnetism, optics, and modern physics.
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. Analyze the interaction of light with different media, including applications to optical instrumentation.
- 6. Analyze the wave-particle duality of light and matter, including the generation of interference patterns and standing waves.
- 7. Evaluate the limitations of classical physics at small scales and large velocities.
- 8. Conduct experiments to acquire and analyze real-world data, with appropriate use of measurements, units, significant figures, and error propagation.
- 9. Relate experimental data and results to the basic physical concepts of electromagnetism, optics, and modern physics.

Lecture Content

Course content parallels similar one-year calculus-based physics sequences found in the UC system (e.g. PHYSICS 3ABC at UCI, PHYSICS 5ABC at UCLA, PHYS 002ABC at UCR, PHYS 6ABC at UCSB, PHYS 1ABC at UCSD). Within its focus on calculus-based physics, this course also covers the content of an algebra/trigonometry-based physics course aligned with C-ID PHYS 110. Electrostatics Fields and Potentials Gauss s Law Capacitance and Dielectrics Current and Resistivity DC Circuits Magnetism Ampere s Law Electromagnetic Induction Faraday s Law and Lenz's Law AC Circuits Maxwell s Equations Electromagnetic Waves Geometric Optics Lenses, Mirrors, and Optical Instruments Wave Optics/ Physical Optics Quantum Mechanics Atomic and Nuclear Physics Special Relativity

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 Coulomb s Law Gauss Law Ohm s Law Resistor Circuits RC Circuits Bar Magnets Ampere s Law Transformers RLC Circuits Mirrors and Images Snell s Law Lenses and Images Wave Interference and Diffraction Standing Waves Spectroscopy

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

Writing Assignments

1 hour 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

4 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 Rationale: . 2. Required Moebs, W., et. al. University Physics Volumes 23, ed. OpenStax College, 2016 Rationale: Latest edition of OER textbook

Manuals Resources

1. OCC Physics Department. PHYS A135 Laboratory Manual, Orange Coast College , 01-01-2024