PHYS A125: ALGEBRA-BASED PHYSICS 2: ELECTRICITY/ MAGNETISM WITH LAB

Item	Value
Curriculum Committee Approval Date	12/06/2023
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
Grading Policy	Standard Letter (S), • Pass/No Pass (B)
Associate Arts Local General Education (GE)	• OC Physical/Biological Sci - AA (OB)
Associate Science Local General Education (GE)	• OCC Physical/Biological Sci-AS (OSB)

Course Description

The second semester of a two-semester sequence with lab (PHYS A120/ A125) covering an algebra/trigonometry-based study of all topics in basic physics. Core topics for this second semester include: electromagnetism, optics, and modern physics. PREREQUISITE: PHYS A120. 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 110.**C-ID:** PHYS 110.

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 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 and currents.
- 2. Apply the concepts of fields and potentials towards the analysis of interactions between point charges, currents, and magnets.
- 3. Analyze DC circuits consisting of combinations of voltage sources, resistors, and capacitors.
- 4. Relate electromagnetic induction and electromagnetic radiation to the interactions 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, and significant figures.
- 9. Relate experimental data and results to the basic physical concepts of electromagnetism, optics, and modern physics.

Lecture Content

Electrostatics Fields and Potentials Current DC Circuits Magnetism Electromagnetic Induction Electromagnetic Waves Geometric Optics Optical Instrumentation Wave 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 Coulombs Law Gauss Law Ohms Law Resistor Circuits RC Circuits Bar Magnets Amperes Law Transformers Mirrors and Images Snells 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

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

Writing Assignments

One 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

Four 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: Masters degree in physics, astronomy, or astrophysics OR bachelors degree in physics or astronomy AND masters degree in engineering, mathematics, meteorology, or geophysics OR the equivalent. Masters degree required.

Textbooks Resources

1. Required Urone, Paul Peter Roger Hinrichs. College Physics 2e, ed. OpenStax College, 2022

Manuals Resources

1. OCC Physics Department. PHYS A125 Laboratory Manual, Orange Coast College , 01-01-2024