Lassen Community College Course Outline

PHYS2B General College Physics II 4.0 Units

I. Catalog Description

This course is a continuation of PHYS 2A, covering mechanical waves (including sound), electricity, magnetism, geometric optics, interference and diffraction and elementary modern physics. This course has been approved for online and hybrid delivery. This course has been approved to be web-enhanced. Access to a computer with internet access is required.

Prerequisite(s): Physics 2A with a grade of C or higher

Transfers to UC/CSU
CSU GE Area: B1 & B3
IGETC GE Area: 5A & 5C
C-ID PHYS 110
51 Hours Lecture, 51 Hours Lab, 102 hours Expected Outside Class Work, 204 Total Student Learning Hours
Scheduled: Spring (odd)

II. Coding Information

Repeatability: Not Repeatable, Take 1 Time
Grading Option: Graded or Pass/No Pass
Credit Type: Credit - Degree Applicable
TOP Code: 190200

III. Course Objectives

A. Course Student Learning Outcomes

Upon completion of this course the student will be able to:

1. Analyze and solve problems involving the applications of the principles of electricity and magnetism, optics, relativity, and atomic theory.
2. Apply critical thinking to the testing of the physics principles of electricity and magnetism, optics, relativity, and atomic theory, using proper laboratory techniques and procedures.

B. Course Objectives

Upon completion of this course the student will be able to:

1. Explain how disturbances in elastic media propagate as waves and know the vocabulary used to describe waves, in particular periodic waves.
2. Explain the principle of linear superposition, and how standing waves can be seen as a superposition of traveling waves.
3. Describe the standing wave modes for various one dimensional systems, given the boundary conditions for a given system.
4. Explain the basic nature of sound, including the way in which the speed of propagation depends on elastic and inertial properties of the medium.
5. Relate ratios of sound intensities to the logarithmic decibel scale.

6. Explain how motion of a sound source and motion of a receiver of sound cause changes in the frequency of the received sound wave.
7. Explain what it means that electric charge is quantized and be able to use Coulomb's law to calculate electric forces in various situations.
8. Define electric field. Be able to use Coulomb's law plus superposition to determine electric fields produced by collections of point source charges.
9. Define electric potential. Be able to apply this in situations involving energy conservation. Understand and be able to use the relationship between the electric field and the potential gradient.
10. Define capacitance and how capacitors can be used to store electrical energy.
11. Define electric current and resistance. Understand the role of EMF in electric circuits and how all of these variables affect the power produced or consumed in circuits.
12. Apply Kirchhoff's laws in analyzing simple circuits.
13. Identify series and parallel connections of circuit elements. Use the ideas of equivalent resistance and capacitance to analyze circuits.
14. Define magnetic field and be able to use it to find forces on moving electric charges. Describe the motion of charged particles in uniform magnetic and/or electric fields.
15. Describe magnetic interactions between electric currents in simple situations.
16. Apply Faraday's law and Lenz's law to describe phenomena involving magnetically induced voltages and currents.
17. Explain the description of light as an electromagnetic wave and with various phenomena relating to the polarization of light.
18. Apply the law of reflection. Understand how mirrors form images, using ray diagrams to describe image formation by concave and convex spherical mirrors.
19. Apply Snell's law to describe refraction of light and know the definition of index of refraction.
20. State the postulates of the special theory of relativity.
21. Solve problems involving time dilation and length contraction.
22. Apply the relativistic energy-mass relation.
23. Explain how the wave nature of light leads to interference effects, and be able to describe the interference pattern from two coherent sources, and interference in thin films.
24. Explain the basics of diffraction by a single slit, and how the resolution of optical instruments is limited by diffraction.
25. Assess the experimental evidence for the quantum description of light.
26. Assess the experimental evidence for the wave nature of matter, and be able to use DE Broglie's relations to describe both light and matter.
27. Assess the semi classical Bohr model of the atom, discrete emission and absorption spectra are explained. Be able to apply this model to spectra of hydrogen-like atoms and to x-ray spectra.
28. Calculate binding energy from atomic mass
29. Use exponential and logarithmic functions to solve problems involving decay rates.
30. Write reaction equations for simple nuclear reactions, including alpha, beta, and gamma decays.
31. Solve problems involving radiation doses.
32. Distinguish between fission and fusion reactions, and use atomic masses to calculate the energy released in such reactions.

33. Use in the laboratory significant figures correctly in reporting data and results of calculations. Present data graphically and be able to interpret these graphs. Write clear and concise abstracts summarizing experiments. Be able to wire simple electric circuits and be able to correctly use a voltmeter and an ammeter to perform measurements. Be able to use a computer to help collect data, perform computations and plot graphs, and to numerically model various physical systems.

IV. Course Content

1. Mechanical Waves
    A. Traveling waves on a string
    B. Superposition of waves
    C. Standing waves
    D. The nature of sound
    E. Sound intensity, the decibel scale
    F. Doppler effect
2. Electrostatics
    A. Electric charge, Coulomb's law
    B. Electric field
    C. Electric potential and its relation to the field
    D. Capacitance
3. Electric Current and DC Circuits
    A. Current and resistance, Ohm's law
    B. EMF
    C. Kirchhoff's voltage and current rules
    D. Series and parallel circuit
4. Magnetism
    A. Magnetic fields and forces on electric currents
    B. Magnetic fields produced by electric currents
    C. Faraday's law, Lenz's law, applications
5. Optics
    A. Light as an Electromagnetic Wave, Polarization
    B. The law of reflection, images formed by plane mirrors and by spherical mirrors
    C. The law of refraction, total internal reflection
    D. Lenses
    E. Interference of light, Young's experiment
    F. Diffraction by a single slit, resolution limited by diffraction
6. Relativity
    A. The Postulates of the Special Theory of Relativity
    B. Time dilation, length contraction, and simultaneity
    C. Relativistic energy
7. Quantum Physics
    A. Quantization of light, photoelectric effect
    B. Wave nature of matter, DE Broglie relations
    C. Bohr's semi classical model of the atom
    D. Production of x-rays and their spectra
8. Nuclear Physics
    A. Nuclear structure
    B. Binding energy and stability of nuclei

C. Radioactivity
    1. Decay rate and half-life
    2. Alpha, beta, and gamma decay
    3. Biological effects of radiation, quantifying radiation dose
    4. Fission and fusion reactions

9. Laboratory (Although the precise content will vary from semester to semester a representative list of lab experiments and activities is given below.)
    A. Standing Waves on a Vibrating String
    B. Resonance in Air Columns
    C. Electric Fields and Equipotential Surfaces
    D. Electrical Energy Equivalent of Heat
    E. Resistance and Ohm's Law
    F. Series and Parallel Circuits
    G. Internal Resistance of a Battery
    H. Magnetic Force on Moving Electric Charges Using a Cathode Ray Tube
    I. Magnetic Force Between Electric Currents Using a Current Balance
    J. Magnetically Induced Voltage and Current
    K. Polarization of Light
    L. Optics of Thin Lenses
    M. Double Slit Interference
    N. Hydrogen Spectrum
    O. Radioactivity

V. Assignments

A. Appropriate readings

Textbook and supplemental material as assigned

B. Writing Assignments

Students will successfully complete the following assignments for each laboratory experiment:

1. Complete a written response to advance study assignments consisting of at least five questions relating to the theory and procedure of the experiment.
2. Present the experimental data, its analysis and associate graphs and calculations in conventional scientific and engineering form.
3. Respond in writing to end of experiment questions regarding conclusions and analysis of error.

C. Expected Outside Assignments

Students will have approximately one chapter per week to read in the required text, and approximately 12 laboratory experiment outlines to study prior to the laboratory experiments. Students will be expected to prepare adequately for each experiment prior to commencing the actual experimental work. Students will have about 8 problems per week to work and turn in.

D. Specific Assignments that Demonstrate Critical Thinking

Students will demonstrate the ability to apply the knowledge and skills acquired by working and submitting approximately eight (8) problems per week illustrative of the material covered in the lecture portion of the course. Students will submit laboratory reports demonstrating ability in the use of procedures, formats, methods, and analytical techniques used by scientists and engineers. Both problems and laboratory reports will incorporate the symbols and language in common usage in this field.

VI. Methods of Evaluation

Traditional Classroom Delivery

Students will be evaluated using a combination of, but not limited to, the following:

1. Homework Assignments
2. Section Quizzes
3. Chapter Tests
4. Laboratory Reports
5. Final Examination

Web-enhanced course

Additional information and resources may be made available to students online, and students may be required to do research and complete and/or submit assignments online. Quizzes may be administered online, but exams and summative assessments must be administered face-to-face.

Online Delivery

A variety of methods will be used, such as: research papers, asynchronous and synchronous discussions (chat/forum), online quizzes and exams, postings to online website, email communications, and digital lab completions.

Hybrid Evaluation

All quizzes and exams will be administered during the in person class time. Students will be expected to complete online assignments and activities equivalent to in class assignments and activities for the online portion of the course. Electronic communication, both synchronous and asynchronous (chat/forum) will be evaluated for participation and to maintain effective communication between instructor and students.

VII. Methods of Delivery

Check those delivery methods for which, this course has been separately approved by the Curriculum/Academic Standards Committee.

☒ **Traditional Classroom Delivery** ☒ Web-enhance course

☒ Hybrid Delivery ☒ Online Delivery ☐ Correspondence Delivery

This is a combined lecture laboratory class. Laboratory experiment topics are closely coordinated with lecture topics. Films and demonstrations will be utilized.

Hybrid Delivery for Courses with a Lab

Hybrid modality may involve face to face instruction mixed with online instruction. A minimum of 1/3 of instruction, including 100% labs, will be provided face to face. The remaining hours will be taught online through a technology platform as adopted by the district.

VIII. Representative Texts and Supplies

Required Textbooks:

Traditional Classroom Delivery

Modified Mastering Physics (with Pearson eText) access code ISBN: 9780134019734
Modified Mastering Physics Access code provides the student with the latest edition e-book for the class: Walker, James; *Physics*, Pearson Education.

Physics Lab Manual:
Will be provided by the instructor.

Supplies: Scientific or Graphing Calculator.

Web-enhanced Course
Modified Mastering Physics (with Pearson eText) access code ISBN: 9780134019734
Modified Mastering Physics Access code provides the student with the latest edition e-book for the class: Walker, James; *Physics*, Pearson Education.

Physics Lab Manual:
Will be provided by the instructor.

Supplies: Scientific or Graphing Calculator.

Online Delivery
Modified Mastering Physics (with Pearson eText) access code ISBN: 9780134019734.
Modified Mastering Physics Access code provides the student with the latest edition e-book for the class: Walker, James; Physics, Pearson Education.

Physics Lab Manual:
The purchase of Labster is required for the course; this purchase should be done via your Canvas course to link virtual lab to specific course.

Supplies: Scientific or Graphing Calculator.

Hybrid Delivery
Modified Mastering Physics (with Pearson eText) access code ISBN: 9780134019734.
Modified Mastering Physics Access code provides the student with the latest edition e-book for the class: Walker, James; Physics, Pearson Education.

Physics Lab Manual:
Will be provided by the instructor.

Supplies: Scientific or Graphing Calculator.

IX. Discipline/s Assignment
Physics/Astronomy

X. Course Status
Current Status: Active
Original Approval Date: 2/15/1988
Revised By: Natalia McClellan
Curriculum/Academic Standards Committee Revision Date: 02/15/2022