Lassen Community College Course Outline

PHYS 2A General College Physics I 4.0 Units

I. Catalog Description

This course provides an introduction to the principles and applications of mechanics, using the mathematical tools of algebra and right triangle trigonometry. Topics include vectors, kinematics, Newton's laws, gravity, energy and momentum, mechanics of rigid bodies, heat, fluids and simple harmonic motion. 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: Successful completion of Math 7 Trigonometry **OR** Math 60 Intermediate Algebra or equivalent multiple measures placement and concurrent enrollment in Math 7 Trigonometry

Prerequisite Skills-

Before entering this course the student will be able to:
Apply the trigonometric definitions of sine, cosine, and tangent to right triangle problems.

Recommended Preparation:
ENG 105 or equivalent multiple measures placement.
Math 8 – Advanced Algebra

Transfers to UC/CSU
General Education Area: A
CSU GE Area: B1 & B3
IGETC GE Area: 5A & 5C
C-ID PHYS 105
51 Hours Lecture, 51 Hours Lab, 102 hours Expected Outside Class Work, 204 Total Student Learning Hours
Scheduled: Fall (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 mechanics, thermodynamics and waves.
2. Apply critical thinking to the testing of the physics principles of mechanics, thermodynamics, and waves, using proper laboratory techniques and procedures.

B. Course Objectives

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

1. Explain the statements of Newton's three laws of motion.
2. Construct correct force diagrams for a variety of situations.
3. Use Newton's laws, in vector form, to solve for unknown forces or acceleration.
4. Use the Law of Gravity to describe gravitational interactions and circular orbits.
5. Relate torque and moment of inertia to the angular acceleration of a rigid body.
6. Define momentum and the conditions under which it is conserved.
7. Define work, kinetic energy and potential energy. Be able to conclude whether the energy of a system is conserved.
8. Use conservation principles, where appropriate, to solve various problems.
9. Apply the law of conservation of angular momentum, where appropriate, to solve problems.
10. Identify energy transformations within a system and energy transfers to or from a system, in the context of the First Law of Thermodynamics.
11. Relate temperature to the average molecular kinetic energy in an ideal gas.
12. Calculate heat transfer using specific heat and/or heat of transformation.
13. Describe energy transfers in heat engines and heat pumps.
14. Distinguish between reversible and irreversible processes and describe how the Second Law makes some energy transformations irreversible.
15. Use forces and torques to solve problems and analyze situations involving the equilibrium of a rigid body.
16. Define pressure and density.
17. Relate pressure to depth in a fluid and to understand how this gives rise to buoyancy.
18. Apply Bernoulli's principle, when appropriate, and Poiseuille's law.
19. Explain how linear restoring forces result in simple harmonic motion. Relate displacement, velocity and acceleration in simple harmonic motion. Explain how period and frequency is related to amplitude, mass and spring constant.
20. Use significant figures in laboratory work correctly to indicate precision of data and calculations based on data. Present data graphically (graphing manually and using computers) and analyze graphs to obtain results (for example by fitting lines with a linear regression). Write clear and concise abstracts to summarize the objectives and outcomes of their experiments.
21. Define velocity and acceleration. Give graphical and algebraic descriptions of uniformly accelerated motion.
22. Add and subtract vectors, graphically and by using vector components.
23. Use vector components to analyze the motion of a freely falling projectile.
24. Relate the velocities of an object observed in two different frames of reference.

IV. Course Content

1. Kinematics
    A. Velocity and acceleration in one dimension
    B. Vectors and the description of motion in two dimensions
    C. Projectile motion
    D. Relative velocities
2. Newton’s Laws
    A. Equilibrium, the First Law, inertial reference frames
    B. The Second Law, inertial mass
    C. The Third Law
    D. Newton's Law of Gravity

E. Contact forces
F. Applications of Newton's Laws
G. Uniform Circular Motion, circular orbits

3. Conservation Laws
    A. Momentum and its conservation in isolated systems
    B. Work and kinetic energy
    C. Conservative forces and potential energy
    D. Mechanical energy with and without dissipative forces
    E. Applications to collisions
4. Mechanics of Rigid Bodies
    A. Torque and the conditions for equilibrium
    B. Center of gravity
    C. Applications, with emphasis on the mechanics of the human body
    D. Rotational kinematics: angular position, angular velocity, angular acceleration
    E. Newton’s second law for rotation, moment of inertia, rotational kinetic energy
    F. Angular momentum
5. Thermodynamics
    A. Temperature and kinetic theory of ideal gases
    B. Heat transfer
    C. First Law of Thermodynamics
    D. Specific Heat, Heat Transfer in Phase Transitions
    E. Reversible and Irreversible Processes, Second Law of Thermodynamics
6. Fluid Mechanics
    A. Pressure and density, contrasting compressible and incompressible fluids
    B. Dependence of pressure on depth
    C. Buoyancy
    D. Equation of continuity
    E. Streamline flow and Bernoulli's principle
    F. Viscosity
7. Oscillations
    A. Elasticity
    B. Linear restoring forces and simple harmonic motion
    C. Examples of simple harmonic motion
8. Laboratory (Although the precise content will vary from semester to semester and depend on the individual instructor's choice, a representative list of lab experiments and activities is given below.)
    A. Accelerated Motion on an Air Track
    B. Analyzing Graphs of Motion Obtained by a Computerized Motion Detector
    C. Measuring the Acceleration of a Freely Failing Object
    D. Force Vectors in Equilibrium
    E. Newton's Second Law - Force, Acceleration and Mass
    F. Investigating Friction
    G. Dynamics of Uniform Circular Motion
    H. Work and Kinetic Energy
    I. Conservation of Mechanical Energy in a Simple Pendulum
    J. Impulse and Momentum
    K. Collisions and Momentum Conservation
    L. Forces, Torques and Equilibrium of a Rigid Body

M. Calorimetry
N. Elasticity
O. Simple Harmonic Motion

V. Assignments

A. Appropriate Readings

Textbook and supplemental materials 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 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 *will be* closely coordinated with lecture topics. Internet sites, simulation programs and demonstrations will be utilized as appropriate.

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: 6/1/1990
Revised By: Natalia McClellan
Curriculum/Academic Standards Committee Revision Date: 02/15/2022