PHYS A130: UNIVERSITY PHYSICS 1: MECHANICS WITH LAB

Item	Value
Curriculum Committee Approval Date	11/03/2021
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)
Associate Arts Local General Education (GE)	• OC Physical/Biological Sci - AA (OB)
Associate Science Local General Education (GE)	• OCC Physical/Biological Sci-AS (OSB)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 5A Physical Science (5A) • Cal-GETC 5C Laboratory Activity (5C)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 5A Physical Science (5A) • IGETC 5C Laboratory Activity (5C)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B1 Physical Science (B1) • CSU B3 Laboratory Activity (B3)

Course Description

Formerly: University Physics 1 (non-majors). The first 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 first semester include: classical mechanics, including waves and fluids, and thermodynamics. Intended for some UC transfer biology majors as well as students needing a one-year sequence in calculus-based physics as a requirement for their major program. Astronomy, chemistry, engineering, and physics majors should enroll in the PHYS A185/A280/A285 sequence. PREREQUISITE: MATH A180, MATH A180H, or MATH A182H. ADVISORY: MATH A185, MATH A185H, or MATH A182H. 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 mechanics and thermodynamics, 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 mechanics and thermodynamics.
3. Conduct experiments using standard scientific methods, evaluate the resulting data, and construct evidence-based conclusions in a written report.

Course Objectives

- 1. State the basic principles of mechanics, fluids, thermodynamics, and waves, define important scientific terms in these areas, and give an explanation of how they apply to real-world situations.
- 2. Use calculus and conceptual reasoning to solve problems involving the laws of mechanics, fluids, thermodynamics, and waves.
- 3. Conduct simple experiments using standard scientific methods, evaluate the resulting data, and construct a scientific conclusion in a formal written report.

Lecture Content

1. Physical quantities, units, dimensional analysis, significant figures, frames of reference 2. Scalars and vectors 3. Particle kinematics, free fall 4. Projectile motion, circular motion, relative motion, Galilean transformation, inertial reference frames 5. Particle dynamics and the three laws of Newton 6. Friction, dynamics of circular motion 7. Work and energy, power 8. Conservative forces, potential energy, conservation of mechanical energy, nonconservative forces, gravitational potential energy 9. Linear momentum, conservation of linear momentum, elastic and inelastic collisions 10. Systems of particles, center of mass and center of gravity, systems of variable mass, rocket propulsion 11. Rotation of a rigid body, rotational kinetic energy, moment of inertia, torque, rotational dynamics of a rigid body 12. Angular momentum, conservation of angular momentum, conditions for static and dynamic equilibrium 13. Newtons law of gravity, gravitational and inertial mass, Keplers l aws of planetary motion 14. Solids and fluids, elastic moduli, Archimedes principle, the equation of continuity, Bernoullis equation, viscosity, surface tension 15. Oscillations, simple harmonic motion, pendulums, damped oscillations, forced oscillations, resonance 16. Mechanical waves, superimposition principle, reflection and transmission, traveling harmonic waves, standing waves, the wave equation 17. Sound waves, resonant standing sound waves, the Doppler effect, beats, sound intensity 18. Temperature, thermal expansion, and the ideal gas law 19. Specific heat, latent heat, mechanical equivalent of heat, work in thermodynamics, the first law of thermodynamics, heat transfer 20. Kinetic theory of gases, specific heats of ideal gases, equipartition of energy 21. Heat engines and the Kelvin-Planck formulation of the second law of thermodynamics, refrigerators and the Clausius statement of the second law, reversible and irreversible processes, the Carnot Cycle, entropy and the second law, entropy and probability, the absolute temperature scale

Lab Content

List of lab experiments: 1 Galileo and the pendulum "g" with a pendulum 2 Acceleration "g" using inclined air-track 3 Free-falling objects and gravitational acceleration "g" 4 Specific gravity

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

1. Lecture and some demonstrations will be used to present the basic concepts. 2. Various methods and strategies of problem solving are taught by thoroughly discussing typical sample problems in the class. 3. Students are provided with an environment that encourages participation with the instructor, i.e. during the office hours of the instructor as well as during the experimentation in the lab, students have the opportunity to interact with the instructor. 4. Students will perform laboratory experiments to further the understanding of applications of the theory.

Reading Assignments

2 hrs/week as assigned by instructor from texts, on-line or library research, and/or instructor handouts.

Writing Assignments

To promote critical thinking component, problem solving will be emphasized in homework and exams. For each laboratory experiment, a conclusion has to be written which contains a critical evaluation of the laboratory results.

Out-of-class Assignments

4 hrs/week of assignments and test preparation emphasizing problem solving and concept application.

Demonstration of Critical Thinking

To promote critical thinking component, problem solving will be emphasized in homework and exams.

Required Writing, Problem Solving, Skills Demonstration

Students will perform laboratory experiments to further the understanding of applications of the theory.Various methods and strategies of problem solving are taught by thoroughly discussing typical sample problems in the class.

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 Halliday, D. and Resnick, R. . Fundamentals of Physics, Extended, latest ed. Atlanta: John Wiley and Sons, 2011 2. Required Learner, L.. Physics for Scientists, latest ed. Chicago: Jones and Bartlett Publishers, 2011 3. Required Moebs, William, et. al.. University Physics, ed. OpenStax College, 2017