PHYS A130: UNIVERSITY PHYSICS 1: MECHANICS 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)
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. Analyze the statics and dynamics of point masses, extended systems, and fluids subjected to constant and variable forces.
- 2. Apply the concepts of linear and angular momentum conservation towards the analysis of mechanical systems.
- 3. Apply the concepts of energy conservation towards the analysis of mechanical and thermodynamic systems.
- 4. Relate the mechanics of particles on the microscopic scale to the properties of thermodynamic systems.
- 5. Conduct experiments to acquire and analyze real-world data, with appropriate use of measurements, units, significant figures, and error propagation.
- 6. Relate experimental data and results to the basic physical concepts of mechanics and thermodynamics.

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 105. Units, Scalars, Vectors Translational Kinematics and Dynamics Newton s Laws Gravitation Rotational Kinematics and Dynamics Statics Work and Energy Linear and Angular Momentum Simple Harmonic Motion Mechanical Waves and Sound Fluid Statics and Dynamics Temperature and Heat Kinetic Theory Laws of Thermodynamics Heat Engines and Entropy

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, significant figures, and error propagation. Representative experiments include investigations of: 1. Measurement and Error Propagation 2. Statistics 3. Free-Fall Acceleration 4. Projective Motion 5. Vectors 6. Newton s Second Law 7. Friction 8. Impulse and Collisions 9. Conservation of Momentum 10. Conservation of Energy 11. Simple Harmonic Motion 12. Standing Waves and Resonance 13. Buoyancy 14. Fluid Dynamics 15. Absolute Zero 16. Calorimetry

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 2. Required Moebs, W., et al. University Physics Volumes 12, ed. OpenStax, 2016 Rationale: Latest edition of OER textbook

Manuals Resources

1. OCC Physics Department. PHYS A130 Laboratory Manual, Orange Coast College , 01-01-2024