

# PHYS A185: CALCULUS-BASED PHYSICS: MECHANICS WITH LAB

| Item                                                                   | Value                                                                                                                             |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Curriculum Committee Approval Date                                     | 09/18/2024                                                                                                                        |
| Top Code                                                               | 190200 - Physics, General                                                                                                         |
| Units                                                                  | 5 Total Units                                                                                                                     |
| Hours                                                                  | 126 Total Hours (Lecture Hours 72; 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)                            | <ul style="list-style-type: none"> <li>Area 5 Physical and Biological Sciences, Scientific Inquiry, Life Science (OB)</li> </ul>  |
| Associate Science Local General Education (GE)                         | <ul style="list-style-type: none"> <li>Area 5 Physical and Biological Sciences, Scientific Inquiry, Life (OSB)</li> </ul>         |
| California General Education Transfer Curriculum (Cal-GETC)            | <ul style="list-style-type: none"> <li>Cal-GETC 5A Physical Science (5A)</li> <li>Cal-GETC 5C Laboratory Activity (5C)</li> </ul> |
| Intersegmental General Education Transfer Curriculum (IGETC)           | <ul style="list-style-type: none"> <li>IGETC 5A Physical Science (5A)</li> <li>IGETC 5C Laboratory Activity (5C)</li> </ul>       |
| California State University General Education Breadth (CSU GE-Breadth) | <ul style="list-style-type: none"> <li>CSU B1 Physical Science (B1)</li> <li>CSU B3 Laboratory Activity (B3)</li> </ul>           |

## Course Description

Formerly: Calculus Based Physics: Mechanics. The first semester of a three-semester sequence with lab (PHYS A185/PHYS A280/PHYS A285) covering a calculus-based study of all topics in fundamental physics. Topics for this first semester include kinematics, dynamics, work and energy, momentum, gravitation, simple harmonic motion, mechanical waves, and fluids. Intended for astronomy, chemistry, engineering, and physics majors, as well as students needing an extended sequence in calculus-based physics as a requirement for their major program. Enrollment Limitation: PHYS A185H; students who complete PHYS A185 may not enroll in or receive credit for PHYS A185H. PREREQUISITE: MATH A180, MATH A180H, or appropriate placement; and Completion of or concurrent enrollment in MATH A185, MATH A185H, or MATH A182H. ADVISORY: One year of high school physics or a semester of college physics. 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 205.C-ID: PHYS 205.

## Course Level Student Learning Outcome(s)

1. State the basic principles of mechanics, define important scientific terms in these areas, and provide explanations of how they apply to real-life situations.
2. Use calculus, algebra, trigonometry, and conceptual reasoning to solve problems involving mechanics.
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 systems.
- 4. Conduct experiments to acquire and analyze real-world data, with appropriate use of measurements, units, significant figures, and error propagation.
- 5. Relate experimental data and results to the basic physical concepts of mechanics.

## Lecture Content

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

## 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: Measurement and Error Propagation Statistics Free-Fall Acceleration Projective Motion Vectors Newton's Second Law Friction Impulse and Collisions Conservation of Momentum Conservation of Energy Simple Harmonic Motion Standing Waves and Resonance Buoyancy Fluid Dynamics

## 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**

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

## **Writing Assignments**

1.5 hours 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**

5 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. Fundamental Physics, Extended, 12 ed. Wiley, 2021 Rationale: Most recent edition of OER textbook  
2. Required Moebs, W., et al. University Physics Volume 1, ed. OpenStax, 2016 Rationale: Most recent edition of OER textbook

## **Manuals Resources**

1. OCC Physics Department. PHYS A185 Laboratory Manual, Orange Coast College, 01-01-2024