PHYS G185: CALCULUS BASED PHYSICS: MECHANICS

Item	Value
Curriculum Committee Approval Date	05/03/2022
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)
Local General Education (GE)	• GWC Physical Universe*** (GB1)
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

This course is an introduction to physics using calculus. Topics studied include vectors, motion, forces, energy, momentum, oscillators, and the properties of waves. PREREQUISITE: MATH G180 or achieve qualifying score on Math Placement. ADVISORY: MATH G185. Transfer Credit: CSU; UC: Credit Limitation: PHYS G120, PHYS G125 and PHYS G185, PHYS G280, PHYS G285 combined: maximum credit, 1 series - deduct credit for duplication of topics. C-ID: PHYS 205. **C-ID:** PHYS 205.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Solve problems involving Newton's Laws using calculus.
3. Solve problems involving energy and energy transfer using calculus.
4. Solve problems involving momentum using calculus.
5. Solve problems involving waves using calculus.

Course Objectives

- 1. Demonstrate the addition, subtraction, and multiplication of vectors.
- 2. Solve problems of one-, two-, and three-dimensional motion.
- 3. Solve problems of rotational motion.
- 4. Apply Newtons Laws of motion to particles.
- 5. Examine the effects of force, mass, and friction on particle motion.
- 6. Examine particle dynamics using conservation of energy.
- 7. Solve problems using conservation of momentum.
- 8. Apply the concepts of torque and angular momentum to solve problems of rotational dynamics.
- 9. Describe the types of waves.
- 10. Explain the superposition, velocity, intensity, reflection, and interference of waves.
- 11. Describe the Doppler Effect.

Lecture Content

Mechanics Kinematics 1. Vectors a. Addition, subtraction, components b. Multiplication by scalar, dot product, cross product2. One-dimensional motion a. Displacement, velocity, acceleration 3. Two- and three-dimensional motion a. Displacement, velocity, acceleration 4. Rotational motion a. Angular displacement, velocity, acceleration Dynamics 1. Particle dynamics a. Newtons laws of motion b. Force, mass, friction 2. Conservation of energy and momentum a. Work, kinetic energy, potential energy b. Conservative and nonconservative systems c. Momentum, center of mass, collisions 3. Rotational dynamics a. Torque, angular momentum, energy, inertia 4. Oscillations a. Simple harmonic motion b. Two-body c. Forced, damped, resonance Waves Elastic waves 1. Types a. Transverse, longitudial b. Traveling, standing 2. Properties a. Superposition b. Velocity, intensity c. Reflection, interference Sound Waves 1. Propagation and velocity 2. Stand ing waves, resonance, beats 3. Doppler effect

Lab Content

Use equipment to collect data pertinent to the motion of particles and waves. Position Velocity Acceleration Force Friction Kinetic energy Potential energy Wavelength Frequency Amplitude Analyze data in graphical form. Perform statistical error analysis of data. Formulate conclusions from data. Practice problem solving techniques.

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- Lab (04)
- DE Live Online Lab (04S)

Reading Assignments

Textbook Instructor hand-outs

Writing Assignments

Regular homework assignments are given which stress problem solving ability, and exams are given which test the students ability to solve such problems. The laboratory portion of the course is designed to give the student practice in making measurements and using equipment, and proficiency is determined by lab exams in which the student is expected to demonstrate the ability to use a piece of equipment to the instructor. In addition, students are expected to maintain lab notebooks which contain calculations and an analysis of each experiment.

Out-of-class Assignments

Homework assignments to reinforce key concepts and develop problem solving skills.

Demonstration of Critical Thinking

Students demonstrate the ability to think critically by analyzing given physical situations (reading word problems and interpreting them), applying the basic laws of physics toward the solution of such problems, deducing valid conclusions from their results, and then explaining these results in terms of non-mathematical ideas. From data collected in the lab, the students will be able to verify and "discover" the basic laws of physics, and use graphs to predict the results of other experiments. Students will then take these ideas and write a lab report that describes the results of their work, as well as answering questions related to the performance of the experiment.

Required Writing, Problem Solving, Skills Demonstration

Regular homework assignments are given that stress problem solving ability, and exams are given that test students ability to solve such problems. The laboratory portion of the course is designed to give students practice in making measurements and using equipment, and proficiency is determined by lab exams in which students are expected to demonstrate the ability to use a piece of equipment to the instructor. In addition, students are expected to maintain lab notebooks that contain calculations and an analysis of each experiment.

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 Tipler, P., Mosca, G.. Physics for Scientists and Engineers, 6th ed. Macmillan Learning, 2020

Manuals Resources

1. Thomason, M.. Lab Manual, Golden West College , 01-31-2022