PHYS G285: CALCULUS BASED PHYSICS: MODERN

Item	Value
Curriculum Committee Approval Date	04/04/2023
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)
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 is a calculus based physics course including the topics of measurement of heat and temperature, effects of heat, kinetic theory of gases, thermodynamics, propagation of light, reflection, refraction, interference, diffraction, relativity, quantum theory and matter waves. PREREQUISITE: MATH G185 and PHYS 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 215. **C-ID:** PHYS 215.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Use the first and second Laws of thermodynamics to solve problems.
3. Apply quantum mechanics and special relativity to physical world phenomena.
4. Examine the laws of reflection and refraction.
5. Calculate solutions to fluid mechanics problems.

Course Objectives

- 1. Explain the difference between heat and temperature.
- 2. Apply the kinetic theory of gases.
- 3. Calculate the answers to problems using the first and second laws of thermodynamics.
- 4. Define the Doppler effect.
- 5. Apply the laws of reflection and refraction.
- 6. Illustrate wave interference.
- 7. Describe fluids, density, and pressure.
- 8. Solve problems using Pascal's principle, Archimedes' principle, and Bernoulli's equation.
- 9. Solve problems involving special relativity.
- 10. Explain phenomena using quantum mechanics.
- 11. Collect data with appropriate sensors and meters to the necessary significant figures.
- 12. Analyze data in graphical form.
- 13. Analyze errors.
- 14. Collect data necessary to determine specific heat and thermal expansion.
- 15. Measure Planck's constant.

Lecture Content

Heat Heat and Temperature Temperature scales Measurement of temperature Thermal expansion Specific heat Heat as a form of energy Kinetic Theory of Gases Equation of state Pressure and temperature Specific heat Equipartition of energy Distribution of speeds Mean free path Thermodynamics First law Second law Carnot cycle Entropy Light Nature and Propagation Speed of light Energy and momentum Doppler effect Reflection and Refraction Huygen principle Laws of refraction Laws of reflection Termat's principle Spherical waves and surfaces Interference Young's experiment Thin films Interferometer Diffraction Single slit Double slit Multiple slits Bragg's law Polarization Sheets Circular polarization Fluid Mechanics Fluids, density, and pressure Pascal's principle Archimedes' principle Fluid dynamics Bernoulli's equation Viscosity and turbulence Modern Physics Relativistic Mechanics Simultaneity Lorentz transformation Invariance Quantum Effects Cavity radiation Photoelectric effect Compton effe ct Hydrogen atom Correspondence principle Wave Nature Matter waves Atomic structure Wave mechanics Uncertainty

Lab Content

1. Collect data with appropriate sensors and significant figures.2. Analyze data in graphical form.3. Perform statistical error analysis.4. Perform experiments involving the measurement of the gravitational constant.5. Perform experiments involving specific heat and thermal expansion.6. Perform experiments involving the measurement of Planck's constant.

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)

Reading Assignments

Textbook and lab handouts.

Writing Assignments

Regular homework assignments are given that stress problem solving ability, and exams are given that test the 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 are students 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

Students are encouraged to read some of the current popular scientific articles found in newspapers and popular scientific journals and magazines, and to watch some of the scientific programs on television. Discussion is also encouraged.

Demonstration of Critical Thinking

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

Required Writing, Problem Solving, Skills Demonstration

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.

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 Tipler, P. Mosca, G. Physics for Scientists and Engineers, 6th (legacy) ed. W. H. Freeman, 2007 Rationale: Classic text

Manuals Resources

1. PASCO Scientific. PASCO Scientific's Physics Labs with Computers, PASCO Scientific , 01-01-2023

Other Resources

1. Instructor prepared handouts