COURSE OUTLINE OF RECORD

Number: PHYS G285  TITLE: Calculus Based Physics: Modern

ORIGINATOR: James Almy  EFF TERM: Fall 2014
FORMERLY KNOWN AS:
DATE OF OUTLINE/REVIEW: 04-11-2014
CROSS LISTED COURSE:
TOP NO: 1902.00
CID: PHYS 215

SEMESTER UNITS: 4.0
HRS LEC: 54.0  HRS LAB: 54.0  HRS OTHER: 0.0
CONTACT HRS TOTAL: 108.0
STUDY NON-CONTACT HRS RECOMMENDED: 108.0

CATALOG 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. UC Credit Limitations: Physics G120, G125 and G185, G280, G285 combined--maximum credit, one series; deduct credit for duplications of topics. C-ID PHYS 215

JUSTIFICATION FOR COURSE:

PREREQUISITES:
- PHYS G185: Calculus Based Physics: Mechanics with a minimum grade of C or better or
- PHYS A185: Calculus Based Physics: Mechanics with a minimum grade of C or better and
- MATH G185: Calculus 2 with a minimum grade of C or better or
- MATH A185: Calculus 2 with a minimum grade of C or better or
- MATH A182H: Calculus 1 and 2 Honors with a minimum grade of C or better or
- MATH C185: Calculus 2 with a minimum grade of C or better

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:
Physics/Astronomy

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00
CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]
GRADING POLICY: Pass/No Pass [ ] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]
OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]
TRANSFER STATUS: CSU Transferable[ ] UC/CSU Transferable[X] Not Transferable[ ]
BASIC SKILLS STATUS: Yes [ ] No [X] LEVELS BELOW TRANSFER: Not Applicable
CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable
NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course
OCCUPATIONAL (SAM) CODE: E
REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:
REQUIRED FOR DEGREE OR CERTIFICATE: Yes [X]
Liberal Arts: Emphasis in Science (Associate in Arts)
Physics (Associate in Arts)

GE AND TRANSFER REQUIREMENTS MET:
IGETC Area 5: Physical and Biological Sciences
   5A: Physical Science
      x
   x
CSU GE Area B: Scientific Inquiry and Quantitative Reasoning
   B1 - Physical Science
   B3 - Laboratory Sciences

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. solve problems involving thermodynamics using calculus.
2. solve problems involving optics using calculus.
3. solve problems involving quantum mechanics and special relativity.
4. solve problems involving Newton's Law of gravity using calculus.
5. solve problems involving fluid mechanics using calculus.
6. use various types of equipment for the purpose of making measurements related to temperature and thermodynamics.
7. employ various types of equipment for the purpose of making measurements related to light and optics, including lasers.
8. construct an accurate record of laboratory work in a notebook and extract information from that record that can be used to write a lab report, just as experimental scientists do when reporting results to a journal for publication.
9. demonstrate understanding of the basic concepts involved in estimating experimental uncertainties and performing an error analysis, including propagation of error for actual experimental data collected in lab.

COURSE OBJECTIVES:
1. solve problems involving thermodynamics using calculus.
2. solve problems involving optics using calculus.
3. solve problems involving quantum mechanics and special relativity.
4. solve problems involving Newton's Law of gravity using calculus.
5. solve problems involving fluid mechanics using calculus.
6. collect data with appropriate sensors and significant figures.
7. analyze data in graphical form.
8. perform statistical error analysis.
9. perform experiments involving measurement of the gravitational constant.
10. perform experiments involving specific heat and thermal expansion.
11. perform experiments involving measurement of Planck's constant.

COURSE CONTENT:
LECTURE CONTENT:

A. Heat
1. Heat and Temperature
   a. Temperature scales
   b. Measurement of temperature
   c. Thermal expansion
   d. Specific heat
   e. Heat as a form of energy
2. Kinetic Theory of Gases
   a. Equation of state
   b. Pressure and temperature
   c. Specific heat
   d. Equipartition of energy
   e. Distribution of speeds
   f. Mean free path
3. Thermodynamics
   a. First law
   b. Second law
   c. Carnot cycle
   d. Entropy

B. Light
1. Nature and Propagation
   a. Speed of light
   b. Energy and momentum
   c. Doppler effect
2. Reflection and Refraction
   a. Huygen principle
   b. Laws of refraction
   c. Laws of reflection
   d. Fermat's principle
   e. Spherical waves and surfaces
3. Interference
   a. Young's experiment
   b. Thin films
   c. Interferometer
4. Diffraction
   a. Single slit
   b. Double slit
   c. Multiple slits
   d. Bragg's law
5. Polarization
   a. Sheets
   b. Circular polarization

C. Modern Physics
1. Relativistic Mechanics
   a. Simultaneity
   b. Lorentz transformation
   c. Invariance
2. Quantum Effects
   a. Cavity radiation
   b. Photoelectric effect
   c. Compton effect
   d. Hydrogen atom
   e. Correspondence principle
3. Wave Nature
   a. Matter waves
   b. Atomic structure
   c. Wave mechanics
   d. Uncertainty

LABORATORY 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.

METHODS OF INSTRUCTION:
A. Lecture:
B. Lab:
C. Independent Study:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:
Reading Assignments
Textbook

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.

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.

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Objective Examinations
Problem Solving Exercises

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.

**TEXTS, READINGS, AND RESOURCES:**

**TextBooks:**

**LIBRARY:**

Adequate library resources include:

**Comments:**

**Attachments:**

[Attached Files]