EFFECTIVE TERM: Summer 2018

Course Identification

COURSE ID: PHYS 4C

Student Learning Outcomes

COURSE TITLE (FULL): Engineering Physics

COURSE TITLE (SHORT): Engineering Physics

COURSE DIVISION: Natural Sciences Division

COURSE DEPARTMENT: Physics and Engineering Department

COURSE SUBJECT: Physics

DISCIPLINE: Physics/Astronomy

TAXONOMY OF PROGRAMS (TOP) CODE: 190200 Physics, General

CROSS LISTED COURSE:

Course Attributes

CREDIT STATUS: D Credit – Degree Applicable

TRANSFER STATUS: A Transferable to both UC and CSU

COURSE BASIC SKILLS STATUS: Not a Basic Skills Course

STUDENT ACCOUNTABILITY MODEL (SAM) CODE: E - Non-Occupational

COURSE CLASSIFICATION STATUS: A Liberal Arts and Sciences

FUNDING AGENCY CATEGORY: Not Applicable

COURSE PROGRAM STATUS: 1 - Program Applicable

REPEATABILITY: Non-repeatable Credit (equates to 0 repeats)

GRADING METHOD: Letter Grade Only

CREDIT BY EXAM: Not Allowed

WORK EXPERIENCE: Not part of co-op work experience education program

Course Workload Values

Faculty Contact Hours	Lecture	Laboratory	Activity	Total
Minimum Contact Hours	72	54		126
Maximum Contact Hours				
Minimum Out of Class Hours	144			144
Maximum Out of Class Hours				
Total Minimum Student Learning Hours	216	54		270
Total Maximum Student Learning Hours				

Unit Value	Lecture	Laboratory	Activity	Total
Minimum Units	4	1		5
Maximum Units				

To Be Arranged (TBA) Hours	Lecture	Laboratory	Activity	Total
Minimum To Be Arranged (TBA) Hours				
Maximum To Be Arranged (TBA) Hours				
Scheduled Hours				

METHODS OF INSTRUCTION

- [ ] Lecture
- [ ] Laboratory
- [x] Lecture and Laboratory
- [ ] Open Entry/Exit
- [ ] Independent Studies
- [ ] Work Experience
- [ ] Other To Be Arranged (TBA)

Class Size: 24

Requisites

Prerequisite PHYS 4B Engineering Physics

Course Outline with Information

CATALOG DESCRIPTION

Calculus-based course covering fluids, sound, electromagnetic waves, relativity, and modern physics. Continuation of Physics 4A and 4B.

SCHEDULE DESCRIPTION

Calculus-based course covering fluids, sound, electromagnetic waves, relativity, and modern physics.

MEASURABLE OBJECTIVES

1. Apply the most appropriate principle(s) of physics to the solution of word problems dealing with fluids, sound, electromagnetic waves, optics, nuclear and modern physics.
2. Use the correct mathematical tools, including unit vector notation, trigonometry and differential and integral calculus to solve word problems dealing with fluids, electromagnetic waves, optics and modern physics.
3. Apply the principles involved in fluids, electromagnetic waves, optics and modern physics to real-world problems.
4. Properly interpret graphs and diagrams illustrating: a) fluid flow, b) wave propagation, c) ray tracing in geometrical optics, and d) electron probability distributions in the atom.
5. Analyze experimental data through proper use of computers, including spreadsheets and graphing software.
6. Identify the structural differences between conductors, insulators and semiconductors, and how these differences manifest themselves in the materials' properties.
7. Compare and contrast the differences and similarities between fission and fusion processes.
8. Determine the propagated error in results calculated from experimental data.

LECTURE TOPICAL OUTLINE

- Fluids at rest
- Fluid dynamics
- Sound waves
- Sound
- Electromagnetic waves and geometrical optics
- Interference and diffraction
- Relativity, photons and matter waves, and particles in bound states
- Atoms and x-rays
- Conductivity of electricity in solids
- Nuclear physics
- Fission and fusion
- Elementary particles

- Final exam

LABORATORY TOPICAL OUTLINE

- Archimedes Principle:

  Measuring the specific gravities (densities) of solids and liquids by using Archimedes principle

- Bernoulli's Principle:

  Measuring the relationship between pressure, fluid velocity and fluid height for a moving fluid

- Standing Waves on a String:

  Investigating the relationship between tension, wavelength, frequency, and linear density for waves on a string

- Speed of Sound:

  Determining wavelength and frequency for sound waves in open and closed tubes

- Doppler Effect

  Investigating the Doppler effect for moving sound sources

- Geometrical Optics:

  Finding and measuring the image distance, focal length, and object distance for a variety of mirrors

- Measuring the index of refraction for various materials

- Thin Lenses:

  Determining the relationship between focal length, object distance, image distance, and magnification for a variety of thin lenses (individually and in combination)

- Interference:

  Using double-slit apparatus to investigate the relationship between wavelength, slit separation, and the observed interference pattern on a screen

- Fraunhoffer Diffraction:

  Determining the slit width for a single slit, and line separation for a diffraction grating

- Using the grating to find the wavelength for blue and red light

- Polarization:

  Investigating the relationship between transmitted light intensity and the number and relative orientation or two or three polarizers in combination

- Special Theory of Relativity:

  Using computer simulation to investigate the relationship between speed, length, and time; relativistic addition of velocities; the Doppler effect and energy-momentum problems

- Planck’s constant:

  Measuring the wavelength/voltage relationship for light-emitting diodes (LEDs) to determine Planck's constant

- Photoelectric Effect:

  Measuring the stopping potential as a function of incident wavelength for LED's

- Applications of Schroedinger Equation:

  Calculating the expectation values for observable variables, and using simulations of the Schrodinger equation for a variety of potential wells

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  Hydrogen Spectra/Rydberg constant:

  Measuring the wavelengths of the first four lines of the Balmer series of hydrogen spectrum using diffraction grating spectrometer

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  Radioactivity:

  Investigating the statistical nature of radioactive decay

- Measuring and modeling the half-life of a radioactive material
- Final exam

METHODS OF EVALUATION

Category 1. Substantial written assignments for this course include:

- Short paragraphs (1 to 3 paragraphs) to answer questions involving fluids, sound, electromagnetic waves, relativity, and modern physics.
- Short paragraphs (1 to 3 paragraphs) explaining phenomena and activities involving fluids, sound, electromagnetic waves, relativity, and modern physics
- A 1- to 3-page document including substantial description of theory, experimental set up, apparatus, data manipulation and graphing, and analysis of results.
- Short, paragraph-long, lab reports explaining activities that have been carried out and phenomena that have been witnessed as part of laboratory activities in fluids, sound, electromagnetic waves, relativity, and modern physics
- Long lab reports, 4 to 8 pages, including substantial description of theory, experimental set up, apparatus, data manipulation and graphing, and analysis of results

Category 2. Computational or non-computational problems solving demonstrations

- Recording data, making observations, and calculating results
- Producing and interpreting graphs of measurements and completing calculations on fluids, sound, electromagnetic waves, relativity, and modern physics
- Calculating quantities given other physical quantities for physics problems involving various phenomena in fluids, sound, electromagnetic waves, relativity, and modern physics

Category 3. Skills Demonstrations

- Using a laser and interference pattern and making appropriate measurements to find a slit width or slit separation
- Writing a computer program modeling some aspect of fluids, sound, electromagnetic waves, relativity, and modern physics and then giving a presentation, either individually or as part of a small group explaining what was done
- Presenting some concept or demonstrate the solution to a problem in fluids, sound, electromagnetic waves, relativity, and modern physics

Category 4. Objective Examinations

- Multiple-choice or short-answer questions on fluids, sound, electromagnetic waves, relativity, and modern physics

SAMPLE ASSIGNMENTS

1. Given the parameters of a space vehicle equipped with a solar sail (initial speed, mass, sail area), determine the time for the ship to travel from Earth's orbit to Mar's orbit.
2. An ultrasound gun emitting a sound wave at 25000 Hertz (Hz) is aimed at a baseball that is thrown directly at the gun. The reflected wave produces 3750 beats/sec with the original wave. What is the speed of the baseball?
3. Given a graph of intensity vs. horizontal displacement on the screen for a double slit illuminated by light with a 623 nm wavelength, find the slit separation and slit width from the graph. Be EXPLICIT in showing how you arrived at your answer. Verify that the intensity of the first side maximum is consistent with your results.
4. If you put a block of p-type material next to a block of n-type material a potential difference will be established across the junction where the two blocks meet. (a) Will the potential be greater on the n-side or on the p-side of the junction? Explain. (b) If you were to connect a battery to the other ends of the n-type and p-type blocks will the junction be more likely to conduct a current if you attach the positive terminal of the battery to the n-type block or if you attach it to the p-type block? Explain.
5. Given the wave function for the hydrogen atoms with n = 2, l = 1, and m = 1, set up the expression you would have to evaluate to determine the probability that the electron is between theta = 0 and theta = pi/3 AND is at the same time between r = a and r = 2a.

TEXTBOOK 1	
Title:	University Physics with Modern Physics
Author(s):	Hugh Young & Roger Freedman
Date:	2013
Online Education Resource:	