Las Positas College
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Course Outline for PHYS 8C

GENERAL PHYSICS III

Effective: Fall 2010

I. CATALOG DESCRIPTION:
PHYS 8C — GENERAL PHYSICS III — 5.00 units

Introduction to oscillations, mechanical waves, thermodynamics, light and optics.

4.00 Units Lecture 1.00 Units Lab

Prerequisite
PHYS 1A - General Physics I
with a minimum grade of C
and

MATH 2 - Calculus II
with a minimum grade of C

Strongly Recommended
PHYS 1C - General Physics III

Grading Methods:
Letter Grade

Discipline:

	MIN
Lecture Hours:	72.00
Lab Hours:	54.00
Total Hours:	126.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. PHYS1A
B. MATH2
1. Graph and differentiate inverse trigonometric functions;
2. Evaluate limits by applying L'Hospital's rule and techniques appropriate to limits of indeterminate forms;
3. Evaluate definite and indefinite integrals by a variety of integration techniques;
4. Apply numerical methods to approximate definite integrals;
5. Evaluate improper integrals;
6. Find arc length and the surface area of a solid of revolution;
7. Solve separable first order differential equations;
8. Solve exponential growth and decay problems;
9. Sketch curves defined by parametric equations;
10. Apply the techniques of calculus to parametric curves;
11. Sketch curves defined by polar equations;
12. Apply the techniques of calculus to polar curves;
13. Apply theorems for differentiation and integration of a power series;
14. Find Taylor and Maclaurin series for a given function;
15. Use the binomial series to find a power series of a function;
16. Perform basic vector algebra in two-space and three-space and interpret the results geometrically;
17. Find dot product and cross product of vectors.

Before entering this course, it is strongly recommended that the student should be able to:

A. PHYS1C

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

A. analyze and solve a variety of problems often using calculus in topics such as
    1. Oscillatory motion
    2. Wave mechanics
    3. Thermodynamics
    4. Geometric optics
    5. Light waves
B. Operate standard laboratory equipment, including computer based data acquisition systems, such as:
    1. Force Sensor
    2. String Vibrator
    3. Resonance Tube
    4. Gas Law Apparatus
    5. Linear Expansion Apparatus
    6. Steam Generator
    7. Calorimeter
    8. Optics Bench and Accessories
    9. Rive Ray Box and Accessories
    10. He-Ne Laser
    11. Michelson Interferometer
C. show increased independence in laboratory, as evidenced by the ability to set-up and perform the experiment based on the instructions in the laboratory manual, and to analyze laboratory data and present experimental results, all without extensive input on the part of the instructor.

V. CONTENT:
A. Oscillatory Motion
    1. Motion of an Object Attached to a Spring
    2. Mathematical Representation of Simple Harmonic Motion
    3. Energy of the Simple Harmonic Oscillator
    4. Comparing Simple Harmonic Motion with Uniform Circular Motion
    5. The Pendulum
    6. Damped Oscillations
    7. Forced Oscillations
B. Wave Motion
    1. Propagation of a Disturbance
    2. Sinusoidal Waves
    3. The Speed of Waves on Strings
    4. Reflection and Transmission
    5. Rate of Energy Transfer by Sinusoidal Waves on Strings
    6. The Linear Wave Equation
C. Sound Waves
    1. Speed of Sound Waves
    2. Periodic Sound Waves
    3. Intensity of Periodic Sound Waves
    4. The Doppler Effect
    5. Digital Sound Recording
    6. Motion Picture Sound
D. Superposition and Standing Waves
    1. Superposition and Interference
    2. Standing Waves
    3. Standing waves in a String Fixed at Both Ends
    4. Resonance
    5. Standing Waves in Air Columns
    6. Standing Waves in Rods and Membranes
    7. Beats: Interference in Time
    8. Nonsinusoidal Wave Patterns
E. Temperature
    1. Temperature and the Zeroth Law of Thermodynamics
    2. Thermometers and the Celsius Temperature Scale
    3. The Constant-Volume Gas Thermometer and the Absolute Temperature Scale
    4. Thermal Expansion of Solids and Liquids
    5. Macroscopic Description of and Ideal Gas
F. Heat and the First Law of Thermodynamics
    1. Heat and Internal Energy
    2. Specific Heat and Calorimetry
    3. Latent Heat
    4. Work and Heat in Thermodynamic Processes
    5. The First Law of Thermodynamics
    6. Some Applications of the First Law of Thermodynamics
    7. Energy Transfer Mechanisms
G. The Kinetic Theory of Gases
    1. Molecular Model of an Ideal Gas
    2. Molar Specific Heat of an Ideal Gas
    3. Adiabatic Processes for an Ideal Energy
    4. The Boltzmann Distribution Law
    5. Distribution of Molecular Speeds
    6. Mean Free Path
H. Heat Engines, Entropy, and the Second Law of Thermodynamics
    1. Heat Engines and the Second Law of Thermodynamics
    2. Heat Pumps and Refrigerators
    3. Reversible and Irreversible Processes
    4. The Carnot Engine
    5. Gasoline and Diesel Engines
    6. Entropy
    7. Entropy Changes in Irreversible Processes
    8. Entropy
I. The Nature of Light and the Laws of Geometric Optics
    1. The Nature of Light
    2. Measurements of the Speed of Light
    3. The Ray Approximation in Geometric Optics
    4. Reflection

5. Refraction
6. Huygen's Principle
7. Dispersion and Prisms
8. Total Internal Reflection
9. Fermat's Principle

J. Image Formation
1. Images Formed by Flat Mirrors
2. Images Formed by Spherical Mirrors
3. Images Formed by Refraction
4. Thin Lenses
5. Lens Aberrations
6. The Camera
7. The Eye
8. The Simple Magnifier
9. The Compound Microscope
10. The Telescope

K. Interference of Light Waves
1. Conditions for Interference
2. Young's Double-Slit Experiment
3. Intensity Distribution of the Double-Slit Interference Pattern
4. Phasor Addition of Waves
5. Change of Phase Due to Reflection
6. Interference in Thin Films

L. Diffraction Patterns and Polarization
1. Introduction to Diffraction Patterns
2. Diffraction Patterns from Narrow Slits
3. Resolution of Single-Slit and Circular Apertures
4. The Diffraction Grating
5. Diffraction of X-Rays by Crystals
6. Polarization of Light Waves

VI. METHODS OF INSTRUCTION:
A. Internet and other computer-based simulations and instructional multi-media
B. Problem solving
C. **Discussion** -
D. **Demonstration** -
E. Laboratory experimentation
F. **Lecture** -

VII. TYPICAL ASSIGNMENTS:
A. Homework assignments from textbook: 1. Assigned Problems (not to be turned in): a. Chapter 17 – Questions 1, 3, 11, 15, 17 b. Chapter 17 – Problems 5, 9, 15, 17, 25, 29, 35, 45, 47 2. Homework Assignment (to be turned in): a. Chapter 17 – Problems 12, 18, 36, 46 B. Laboratory reports (individual and group), including computer-based data acquisition and analysis: 1. Measuring the Speed of Sound in Air: In Part A of this laboratory, you will investigate the relationship between frequency, amplitude, and character of sound waves using the Fourier Transform. In Part B, you will use the principle of resonance to determine the speed of sound in a partially enclosed tube. 2. Reflection and Refraction of Light: In this laboratory, you will become acquainted with the reflective properties of convex and concave mirrors; become familiar with the properties of refraction; become familiar with the focal properties of reflection and refraction; measure the focal length of a lens; set up a refracting telescope and compare two different eyepieces. C. Special Exercise worksheets, problem review and computer simulations and tutorials; both individual and group work 1. Web assignment: Superposition of Standing Waves listed in the on-line syllabus. Complete sections (a) through (c) and turn in with the report for the laboratory Measuring the Speed of Sound. 2. Complete assignment Fourier Transforms listed in the on-line syllabus. Work together in groups of two or three and turn in with report for the laboratory Transverse Traveling Waves. Be sure to include an Excel spreadsheet and graph with your report. 3. From the Physlet Physics manual, complete Exploration 33.1: Image in a Flat Mirror, Exploration 33.2: Looking at Curved Mirrors, Exploration 33.3: Ray Diagrams, Exploration 33.4: Focal Point and Image Point, and Exploration 33.5: Convex Mirrors, Focal Point, and Radius of Curvature. Turn in your work with the Chapter 36 homework set.

VIII. EVALUATION:
A. **Methods**

1. Exams/Tests
2. Quizzes
3. Projects
4. Home Work
5. Lab Activities

B. **Frequency**

1. Frequency
a. Recommend bi-weekly or tri-weekly quizzes and final exam (or) two or three midterm (unit) exams and final exam.
b. Weekly or bi-weekly homework assignments (as described above).
c. Weekly or bi-weekly laboratory reports (as described above).
d. Two or more collaborative laboratory assignments per semester (as described above).
e. Two or more computer assignments per semester (as described above).

IX. TYPICAL TEXTS:
1. R. Knight *Physics for Scientists and Engineers. .* 2nd ed., Pearson Education, 2009.
2. W. Christian and M. Belloni *Physlet Physics: Interactive Illustrations, Explorations, and Problems for Introductory Physics.* 1st ed., Pearson Education, 2004.
3. D. C. Baird *Experimentation: An Introduction to Measurement Theory and Experiment Design.* 3rd ed., Prentice-Hall Inc, 1995.
4. Las Positas College Physics 8C Laboratory Manual, available online in PDF format

X. OTHER MATERIALS REQUIRED OF STUDENTS:
A. Programmable scientific calculator capable of graphing
B. Campus print card