Las Positas College
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Course Outline for PHYS 1B

GENERAL PHYSICS II

Effective: Fall 2017

I. CATALOG DESCRIPTION:
PHYS 1B — GENERAL PHYSICS II — 5.00 units

Introduction to fluid dynamics, 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

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
1. Construct vectors in three dimensions to model physical phenomena, and perform algebraic calculations with these vectors.
2. Use algebra, trigonometry, geometry, and calculus to model physical phenomena and calculate relevant physical parameters.
3. Predict the future trajectory of an object moving in two dimensions with uniform acceleration.
4. Analyze a physical situation with multiple constant forces acting on a point mass using Newtonian mechanics.
5. Analyze a physical situation with multiple forces acting on a point mass or extended object using concepts of work and energy.
6. Analyze a physical situation with multiple forces acting on an extended object using the concept of torque.
7. Calculate the moment of inertia and angular momentum of an extended object or system of objects, using calculus if necessary.
8. Analyze collisions of point masses and extended objects using the concept of conservation of linear and angular momentum.
9. Analyze situations in which the gravitational acceleration changes as a function of distance using Newton’s Law of Universal Gravitation.
10. Design, perform, analyze, and assess the effectiveness of simple experiments to demonstrate physical phenomena.
11. Operate standard laboratory equipment and analysis tools, including digital data acquisition systems, spreadsheet programs, and plotting programs.
12. Analyze real-world experimental data, including appropriate use of error propagation, units and significant figures.
13. Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.
14. Write comprehensive laboratory reports that describe the scientific basis of the experiment, clearly explain the experimental procedure, present a complete mathematical analysis of data and uncertainties, and evaluate the effectiveness of the experiment based on calculated uncertainties.

B. MATH2
1. Graph, differentiate, and integrate inverse functions and transecdental functions such as trigonometric, exponential and logarithimic functions;
2. Evaluate definite and indefinite integrals by a variety of integration techniques;
3. Apply numerical methods to approximate definite integrals;
4. Evaluate improper integrals;
5. Use integration to solve applications such as work, arc length and the surface area of a solid of revolution;
6. Solve separable first order differential equations;
7. Solve exponential growth and decay problems;
8. Find Taylor and Maclaurin series for a given function;

9. Use the binomial series to find a power series of a function;

IV. MEASURABLE OBJECTIVES:

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

A. Analyze hydrodynamic situations using the definition of pressure and/or Bernoulli's Principle.
B. Analyze the temperature, pressure, and volume of a system using the laws of thermodynamics.
C. Analyze interacting physical systems, including heat engines, using the laws of thermodynamics and the concept of entropy.
D. Analyze physical situations involving simple and/or damped harmonic motion using concepts of force and energy.
E. Analyze the properties of traveling and standing waves using differential equations and the concept of wave superposition.
F. Analyze basic physical situations involving reflection and refraction, and use this analysis to predict the path of a light ray.
G. Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.
H. Design, perform, analyze, and assess the effectiveness of simple experiments to demonstrate physical phenomena.
I. Operate standard laboratory equipment and analysis tools, including digital data acquisition systems, spreadsheet programs, and plotting programs.
J. Analyze real-world experimental data, including appropriate use of units and significant figures.
K. Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.

V. CONTENT:

A. Fluid Mechanics
   1. Pressure and Variation of Pressure with Depth
   2. Pressure Measurements
   3. Buoyant Forces and Archimedes' Principle
   4. Fluid Dynamics
   5. Bernoulli's Equation
   6. Other Applications of Fluid Dynamics

B. 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
C. 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
D. Sound Waves
   1. Speed of Sound Waves
   2. Periodic Sound Waves
   3. Intensity of Periodic Sound Waves
   4. The Doppler Effect
E. 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
F. 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
G. 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. Applications of the First Law of Thermodynamics
   7. Energy Transfer Mechanisms
H. 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
I. 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
J. 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

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

L. 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
7. Interferometry

M. 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. **Lab** -
B. **Lecture** -
C. Internet and other computer-based simulations and instructional multi-media
D. **Demonstration** -
E. Problem solving
F. **Discussion** -

VII. TYPICAL ASSIGNMENTS:

Assignments include weekly or bi-weekly homework assignments with an average of 10-15 word problems per assignment. Weekly or bi-weekly practice problems may be worked on collaboratively during class, for practice only. Weekly laboratory activities take place which may involve direct experimentation, computer analysis, theoretical calculations, and written lab reports.

VIII. EVALUATION:

A. **Methods**
1. Exams/Tests
2. Quizzes
3. Papers
4. Oral Presentation
5. Projects
6. Class Participation
7. Class Work
8. Home Work
9. Lab Activities

B. **Frequency**
1. 3-5 exams per semester
2. quizzes weekly or bi-weekly, between exams, if desired
3. special topic research paper once per semester, if desired
4. oral presentations on lab work a few times per semester, if desired
5. long-term projects once or twice per semester, if desired
6. daily class participation and classwork, if desired
7. weekly or bi-weekly homework assignments
8. weekly lab activities, with lab report papers assigned every few weeks

IX. TYPICAL TEXTS:

1. Knight, Randall. *Physics for Scientists and Engineers: A Strategic Approach with Modern Physics.* 4th ed., Pearson Education, 2017.
2. Young, Hugh, and Roger Freedman. *University Physics.* 14th ed., Pearson Education, 2016.
3. Halliday, David, Robert Resnick, and Jearl Walker. *Fundamentals of Physics (Extended).* 10th ed., Wiley, 2013.
4. Las Positas College Physics 1B Laboratory Manual, available online in PDF format

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Programmable scientific calculator capable of graphing
B. Campus print card