PHYS 2020

Division: Natural Science and Mathematics
Department: Physics
Course: PHYS 2020
Title: College Physics II
Catalog Description:

PHSX 2020 is the second semester of a two-semester sequence in algebra/trigonometry-based general physics. The course is designed for students majoring in pre-medical, pre-dental, pre-pharmacy, and other biological sciences. The topics covered include vibrations and waves, sound, an introduction to electricity, magnetism, circuits, optics, and relativity. Concurrent registration for the laboratory course PHYS 2025 is required.

General Education Requirements: N/A
Semesters Offered: Spring
Credit/Time Requirement: Credit: 4; Lecture: 4; Lab: 0
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: PHYS 2010

Corequisites: PHYS 2025

Justification:

This course is a necessary component of the curriculum for pre-medical, pre-dental, pre-pharmacy, and other biological science majors. It is fully transferable to all higher education institutions in the state of Utah (same course number at all institutions).

Student Learning Outcomes:

Students will know the important scientific laws and principles, such as those that govern sound, waves, electricity, magnetism, and light. Students will also understand that science is a process to gain knowledge. Students will be able to solve paper-and-pencil physics problems and apply them to real life.

Students will believe that the physical world is interesting, and that science is a valuable way to understand it.

Content:

- Vibrations and Waves
  - Hooke s law
  - Elastic potential energy
  - Velocity as a function of position
  - Simple harmonic motion vs. uniform circular motion
  - Motion of a Pendulum

- Types of waves
- Frequency, amplitude, and wavelength
- Superposition and interference of waves

- Sound
  - Producing a sound wave
  - Characteristics of sound waves
  - Speed, energy, and intensity of sound waves
  - The Doppler effect
  - Interference and standing sound waves
  - Forced vibrations and resonance
  - Standing waves in air columns
  - Quality of sound
  - sound detection in the ear

- Electric Forces and Electric Fields
  - Properties of electric charges
  - Coulomb s Law
  - Electric field lines
  - Conductors in electrostatic equilibrium
  - The Millikan oil-drop experiment
  - The Van de Graff generator and the oscilloscope
  - Electric flux and Gauss Law

- Electric Energy and Capacitance
  - Electric potential and potential difference
  - Potentials, conductors, and equipotential surfaces
  - Capacitance and capacitors
  - Dielectrics

- Current and Resistance
  - Electric current and drift speed
  - Ohm s Law
  - Resistance, Resistivity and the influence of temperature
  - Electrical energy and power

- Direct Current Circuits
  - Electromotive force
  - Resistors in series and parallel
  - Kirchhoff s Rules
  - RC circuits

- Magnetism

    - Effect of magnetic fields on charges
    - Sources of magnetic fields; Biot-Savart Law
    - Ampere s Law
    - Magnetic flux

- Faraday s Law and Inductance
    - Lenz s Law
    - RL circuits
    - Energy in a magnetic field
    - Oscillations in LC circuits

- Alternating Current Circuits
    - Phasors
    - Power
    - Resonance
    - Transformers

- Electromagnetic Waves
    - Maxell s Equations
    - Energy, momentum, and radiation pressure
    - The spectrum of electromagnetic waves

- Nature of Light and Geometric Optics
    - Speed of light
    - Reflection and refraction
    - Dispersion and total internal reflection
    - Images formed by lenses and mirrors

- Interference, Diffraction, and Polarization of Light Waves
    - Young s Double Slit Experiment
    - Narrow slits and the diffraction grating
    - Polarization of light waves

- Optical Instruments
    - The camera
    - The human eye
    - The simple magnifier
    - The compound microscope
    - The telescope
    - Resolution of single-slit and circular apertures
    - Diffraction gratings and the Michelson interferometer

- Relativity

- Michelson-Morley Experiment
- Einstein s Special Relativity
- Einstein s General Relativity

- Introduction to Quantum Mechanics
  - Blackbody radiation
  - Photoelectric effect and the Compton Effect
  - Bohr s model of the atom
  - Wave-particle duality

General Education Outcomes:

6) Apply computational skills to a variety of contexts.
Students solve 15-20 homework problems per chapter; most of which require computation. They receive scores and feedback on their assignments. They also learn to use graphing calculators and other computational tools to aid their solution of physics problems.

7) Apply scientific reasoning to a variety of contexts.
Students frequently answer questions in front of the class. They also present problems to the rest of the class. The tests have a significant portion dedicated to conceptual questions where students must apply scientific reasoning. The homework also requires scientific reasoning to solve the problems.

Key Performance Indicators:

Homework problems: 15%-30% of the final grade
Quizzes: 15%-30% of the final grade

Tests: 20%-40% of the final grade

Comprehensive final exam: 15%-35% of the final grade

Representative Text and/or Supplies:
College Physics, current edition, by Raymond S. Serway and Jerry S. Faughn.

Optimum Class Size: 18
Maximum Class Size: 24

Signatures:

I hereby submit this course syllabus:

Ted Olson, , Professor

I hereby find this course consistent with the goals and resources of the Physics Department:

Ted Olson, , Professor, Chair

I hereby find this course consistent with the goals and resources of the Natural Science and Mathematics Division:

Dan Black, EdD, Associate Professor, Dean

I have discussed the need for library resources related to this class with the person submitting the syllabus:

Lynn Anderson, MLIS, Technical Services Librarian (Main Campus)

Michelle Olsen, MLS, Campus Librarian (Richfield Campus)