PHYS 2220

Division: Natural Science and Mathematics
Department: Physics
Course: PHYS 2220
Title: Physics for Scientists and Engineers II
Catalog Description:

PHSX 2220 is the second semester of a two-semester sequence in calculus-based physics for scientists and engineers. It is a necessary preparation for continuing studies in upper division courses. It includes an introduction to electricity, magnetism, circuits, optics, and relativity. The methods of calculus are applied to develop theories and to solve problems.

General Education Requirements: N/A
Semesters Offered: TBA
Credit/Time Requirement: Credit: 4; Lecture: 4; Lab: 0
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: PHSX 2210

Corequisites: PHSX 222L

Justification:

This course is a necessary component of the curriculum for geology, chemistry, computer science, physics, math, and engineering 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 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:

- Electric Fields
    - Properties of electric charges
    - Coulomb's Law
    - Gauss' Law

- Electric Potential and Capacitance

- Potential difference
- Capacitance and capacitors
- Dielectrics

- Current and Resistance
  - Ohm's Law
  - Resistance and temperature
  - Electrical energy and power

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

- Magnetic Fields
  - 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
  - Oscillations in LC circuits

- Electromagnetic Waves
  - Maxwell's Equations
  - Energy, momentum, and radiation pressure
  - The spectrum of electromagnetic radiation

- 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

- Relativity
    - Michelson-Morely 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 spreadsheets 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. The tests also 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:
Physics for Scientists and Engineers, current edition. (There are various equivalent texts with the same name by different authors.)

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)