



PHYS 2210

Division: Natural Science and Mathematics

Department: Physics

Course: PHYS 2210

Title: Physics for Scientists and Engineers I

Catalog Description:

PHSX 2210 is the first 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 Newton's Laws of Motion, momentum and energy conservation, rotations, oscillations, waves, and gravitation. 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: MATH 1210

Corequisites: PHYS 221L

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 Newton's Laws. 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:

- Physical quantities, measurement standards, math tools
 - Systems of units
 - Reference frames
 - Vectors and vector algebra

- Kinematics (motion) in one dimension

- Displacement, velocity, and acceleration
- Freely-falling bodies
- Relative motion

- Kinematics (motion) in two and three dimensions
 - Displacement, velocity, and acceleration
 - Projectile motion
 - Circular motion, centripetal acceleration

- Dynamics (causes of motion)
 - Newton's Laws of Motion
 - Weight versus mass
 - Frictional and resistive forces

- Work and energy
 - Kinetic energy and potential energy
 - Work-energy theorem
 - Conservation of energy
 - Power

- Momentum and collisions
 - Center of mass
 - Impulse and momentum
 - Conservation of linear momentum
 - Elastic and inelastic collisions

- Rotation and rotational dynamics
 - Angular displacement, velocity, acceleration
 - Kinetic energy of rotation
 - Rotational inertia and torque
 - Angular momentum

- Equilibrium and Elasticity
 - Conditions for equilibrium
 - Center of gravity
 - Elastic properties of solids

- Gravitation
 - Newton's Law of Universal Gravitation
 - Kepler's Laws
 - Gravitational field and gravitational potential energy
 - Satellite motion

- Fluid Dynamics
 - Pressure
 - Buoyant forces and Archimedes' Principle
 - Bernoulli's Principle

- Periodic and oscillatory motion
 - Simple harmonic motion
 - Hooke's Law
 - The Pendulum

- Mechanical waves
 - Traveling waves
 - Superposition and interference
 - Reflection and transmission
 - Standing waves

- Sound waves
 - Speed of sound
 - Intensity
 - Resonance, beats
 - Doppler effect

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)