PHYS 2710

Division: Natural Science and Mathematics
Department: Physics
Course: PHYS 2710
Title: Introductory Modern Physics
Catalog Description:

This course is an introduction to modern, or 20th century physics. PHYS 2710 is required for Physics majors, recommended for Chemistry majors and some engineering majors. Topics covered include relativity, quantum mechanics, atomic and nuclear physics, solid state physics, and cosmology.

General Education Requirements: N/A
Semesters Offered: Spring
Credit/Time Requirement: Credit: 3; Lecture: 3; Lab: 0
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: MATH 1220

Corequisites: PHYS 2220 (or previously), MATH 2210 (or previously)

Justification:

This course is an important component of the curriculum for physics majors in the first two years. It is also recommended for other majors such as Chemistry as preparation for upper division content. This course will transfer to USU's PHYS 2710, WSU s PHYS 2710, and BYUI s PH 309.

Student Learning Outcomes:

Students will know the important scientific laws and principles in 20th century physics. 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:

- Review of classical physics and outstanding problems
    - Waves and particles
    - Laws of conservation
    - Problems
        - Electromagnetic medium
        - Blackbody radiation
        - Ultraviolet catastrophe

- Special Relativity

- Principle of equivalence
- Gravity as bent space
- Black holes

- Origins and experimental evidence for Quantum Theory
  - Blackbody radiation
  - Photoelectric effect
  - Compton effect
  - Elastic and inelastic collisions

- Structure of the atom
  - Atomic models of Thomson and Rutherford
  - Classical atomic model
  - Bohr model
  - X0ray spectra

- Wave properties of matter
  - De Broglie waves
  - Probability and wave function
  - Uncertainty principle

- Quantum Theory
  - Schrodinger wave equation
  - Square well potential
  - Simple harmonic oscillator
  - Barriers and tunneling

- Hydrogen atom
  - Solution to Schrodinger equation
  - Quantum numbers
  - Magnetic effects
  - Spin

- Many-electron atoms
  - Periodic table
  - Angular momentum

- Statistical Physics
  - Maxwell velocity distribution
  - equipartition theorem
  - Classical and quantum statistics

- Molecules and solids
    - Molecular bonding
    - Stimulated emission and lasers
    - Superconductivity
    - Band theory, semiconductors

- Nuclear Physics
    - Radioactive decay
    - Fission
    - Fusion

- Elementary particles
    - Fundamental forces
    - Conservation laws and symmetries
    - Quarks
    - The Standard Model and unification

- Cosmology
    - Evidence of the big bang
    - Stellar evolution
    - Age and future of the universe

General Education Outcomes:

6) Apply computational skills to a variety of contexts.
Students solve homework problems from each chapter; most of which require computation. They receive scores and feedback on their assignments.

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:

Modern Physics for Scientists and Engineers, by Thornton and Rex, current edition.

Optimum Class Size: 10
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)