

PHYC 100 Conceptual Physics

Course Description

Includes a survey of physics with conceptual emphasis on basic classical and modern concepts of matter, motion, energy, and forces with application to mechanics, heat, sound, electricity and magnetism, light, atomic, nuclear, and elementary particles. (3 credit hours)

Course Objectives

As to course-specific goals, students will learn to:

describe motion in a scientifically disciplined way, identify the laws applying to the motion of bodies and apply these laws in a variety of physical contexts.

identify universal laws of physics that underlie all natural phenomena – conservation laws of energy and momentum; the law of entropy increase, and describe how they impact our daily life.

describe and apply physical laws to a variety of disciplines and activities outside physics such as sports (energy, momentum), sound and music, technology (circuits, magnetism, optics, modern physics) and health science (radioactivity)

describe the character of force fields as a major unifying characteristic of physical law, and identify rich interconnections between various field-related phenomena that give rise to the unification of physics in electricity, magnetism, optics, and modern physics.

explain the major issues leading to the revolution in the modern description of physics and identify their connection to the technological revolutions we experience today.

Objectives common to all introductory courses in Physics include:

to recognize which physical laws apply to a given scientific situation and predict behavior by applying logical and critical thinking skills.

in problem solving, identify pertinent facts, recognize what needs to be found, and apply of physical laws to arrive at a conceptual or quantitative solution.

in lab activities, predict outcomes and conduct experiments to test those predictions;

make observations and use scientific instruments to measure physical quantities;

recognize patterns in data and compare results with theory;

describe and justify the results of the laboratory experiment in written reports.

Course Rationale

PHYC 100 is a beginning course designed to introduce the concepts of classical and modern physics to students in any discipline. Students learn the fundamental laws and facts of nature that govern their physical environment, serve as the basis for all technology, and provide the boundaries for technological solutions to societal problems. The overview of natural order and interrelatedness broadens and deepens student perspectives, increases their usable knowledge base, and provides a foundation for informed decision-making on issues involving the development or application of technology.

Course Content, Format and Bibliography

Content

Major course topics are listed in the following example course schedule.

Week	Major Topic	Lecture Topics	Lab Experiment
1	Mechanics	Linear Motion	Practicing a lab report
2		Newton's Laws	Displacement, velocity, and acceleration
3		Momentum and Energy	Acceleration due to gravity
4	Heat & Thermodynamics	Rotational Motion, Gravity	Using accelerometers to study impulse in collisions
5		Thermal energy, The laws of thermodynamics	Conservation of Energy
6	Waves and Sound	Vibrations and Waves	Basics of waves
7		Sound and Music	Sound and music
8	Electricity and Magnetism	Electrostatics	Three fields
9		Electric Currents and Circuits	Circuits I
10	Optics	Magnetism	Circuits II
11		Electromagnetic Induction	Connection between electricity and magnetism
12		Geometrical: Reflection and Refraction	Introduction to optics
13		Physical: Interference, Diffraction	Interference and polarized light
14	Modern Physics	Light Emission and Absorption; Photons and Quantization	Introduction to modern physics
15		Relativity, Atomic and Nuclear Physics	Radioactivity

Format

The instructional format for PHYC 100 is multi-faceted and includes lecture, laboratory, demonstrations, and group activities. Students attend two fifty-minute lecture periods and one two-hour lab session each week. In-class activities draw upon a rich ecosystem of pedagogical tools developed by physics education research. Multimedia are extensively used in the lecture and include video clips, computer simulations, PowerPoint and “Elmo” slides, and internet site visits. Demonstrations are given in class by the course instructor using on-site hardware and are integrated with student prediction and discussion. The laboratory is a weekly, mostly active engagement, two-hour session during which student teams (two students per team) conduct an experimental investigation on a course topic. Electronic audience response devices or “clickers” are available and may be used as an integral part of the in-class experience.

Bibliography

The textbook used in this class in recent years is “Conceptual Physics, Tenth Edition” by Paul Hewitt, (Cummings, ISBN 0-8053-9190-8) or comparable text and the locally developed lab manual Howes, Lab Manual, BSU.