Master Syllabus Department of Physics and Astronomy



PHYC 140 General Physics 1

Course Description

A first course in calculus based physics. Topics include Newtonian mechanics, work and energy concepts, impulse and momentum, elasticity, wave motion and sound, hydrostatics and hydrodynamics. Course content is the same as the lecture portion of PHYCS 120. This course uses a computer- based content delivery system (internet, CD ROM, etc.) and is designed for students who prefer a self-paced individualized learning environment. (4 credit hours)

Prerequisite or parallel: MATH 161 or MATH 165.

Students cannot get credit for both PHYC 120 and PHYC 140.

Course Objectives

This course shares the same general objectives as PHYC 120. As such, it serves as a foundation content course for students pursuing a major or minor in physics, pre-engineering, and other closely related disciplines. Some specific objectives are:

Students will learn factual knowledge. This knowledge may then be applied in other fields in which the student is interested and/or provide a basis for further study in physics. Further, it will provide a basis of knowledge that the student can draw upon later in life to help understand technical and scientific advances.

Students will learn the basic fundamentals of precise scientific terminology. This will enable the student to communicate more effectively later in life as they work in various professional careers. For example, the fundamental physical systems of units as applied to the descriptions of mass, length, time, force, energy, power, temperature, electrical terms, optical phenomena, acoustics, etc., are introduced and developed in PHYC 140 and PHYC 142.

Students will develop problem solving techniques. One of the most important aspects of introductory physics courses is the development of problem solving skills. Students are challenged with assignments that require problem analysis and solution development of a quantitative nature. This will assist the students in developing their abilities to think analytically and reason critically.

Students will see how the mathematical skills learned in calculus courses can be applied in real world situations.

Course Rationale

As technology has advanced over the last few decades, the capability of producing high- quality multimedia courseware has correspondingly improved. Now, computer-based courseware can be produced for delivery over the internet and/or via CDROM that can be accessed by students in an individualized self-paced learning environment. PHYC 140 is designed to enable the Department of

Physics and Astronomy at Ball State to offer distance-learning students the opportunity to take the lecture portion of the calculus-based general physics sequence using high quality multimedia courseware.

The current calculus-based general physics course, PHYC 120 (5 semester hrs), incorporates an integrated laboratory. The PHYC 140 (4 semester hrs) and PHYC 141 (1 semester hr), effectively decouple the content (traditional lecture) and laboratory portions of the course. This provides the opportunity for students to separately schedule each of them for additional flexibility (PHYC 141 can be taken concurrent with but not prior to PHYC 140).

This separation of lecture and laboratory portions of this course is something that is not uncommon at other universities.

At present, the current PHYC 120 course will remain as it is for traditional on-campus learning.

Following are some considerations that support separate offerings of the lecture and laboratory portions of the current PHYC 120/122 series:

Distance education courses for the introductory general physics courses have the potential for increasing enrollments for major and minor programs. While the laboratory portion of the course may still require on-campus work, it may be attractive for some students to get started with BSU courses by taking the content portions of the course only. In addition, some high school students may elect to take such courses for advanced placement purposes.

Many institutions currently offer separate physics lecture and laboratory courses rather than as an integrated whole. - Transfer to/from BSU will be facilitated in such cases by the separation of the content and lab portions of the course.

Students that repeat the current PHYC 120 or PHYC 122 courses are often allowed to repeat just the lecture portion and keep their previous laboratory scores. Separation of the courses would simplify this situation.

Separation of the content and laboratory portions of the general physics sequence will provide greater focus on each, with the result that students will feel a greater need to achieve success separately in each component.

Course Content, Format and Bibliography

Content

Topics to be studied are the same as those in the traditional PHYC 120 course.

These include the following: (the list is illustrative, not exhaustive of the topics typically covered):

- Measurement: systems of units, significant figures
- Vectors: graphical and analytical combination of vectors, dot and cross products

- Uniformly accelerated motion: displacement, velocity, acceleration relationships, freely falling objects, projectile motion Newton's laws of motion: first, second, and third laws of motion. Applications of each. Inclined plane problems, friction.
- Work, energy, power: kinetic and potential energy, conservation of energy
- Momentum and impulse: definitions of impulse and momentum, relationship to
- Newton's second law, conservation of momentum in collisions, elastic and inelastic collisions.
- Rotational motion: angular kinematics, torque, uniformly accelerated rotational motion, moment of inertia, rotational energy and angular momentum, centripetal acceleration and force, gravitation and orbital motion, Kepler's laws.
- Translational and rotational equilibrium: statics problems in two dimensions
- Vibrations: simple harmonic motion, elastic potential energy, simple pendulum
- Hydrostatics: fluid pressure, Archimedes' principle, Pascal's principle
- Hydrodynamics: equation of continuity, Bernoulli's equation, applications, viscosity, Poiseuille's law, Stoke's law
- Wave motion: mathematical description of traveling waves, transverse and longitudinal waves, standing waves, interference, resonance
- Sound: speed of sound, wavelength, frequency, pitch, sound intensity, decibel scale, beats, Doppler effect.

Methods of evaluating student performance: Course grades will be based on the student's performance on homework solutions, three semester exams and one final exam. Exam delivery will be accomplished in the usual way through the offices of Continuing Education, or the student may come to campus to take the exams if they so wish.

Format

The student will engage the content of this course by means of CDROM multimedia. Interaction with the professor at the Department of Physics and Astronomy will be via the internet (Web page, email). Students will work at their own pace (although efforts will be made to have them complete the course in a timely fashion). Assignments and homework can be delivered either electronically or by conventional mail.

Bibliography

Textbook: Physics for Scientists and Engineers, 8th edition, by Serway and Jewett, Brooks/Cole CENGAGE Learning.