PHYCS 142 General Physics 2

Course Description

A continuation of PHYC 140. Topics include heat and laws of thermodynamics, Coulomb's law and the electric field, Ampere's law and the magnetic field, introduction to Maxwell's equation, DC and AC circuits; the nature, propagation, and properties of light; and lens systems. An optional introduction to selected topics in modern physics may be included. Computer-based content delivery for self-paced learning. (4 credit hours)

Prerequisite: PHYC 140 and MATH 162.

Course content is the same as the lecture portion of PHYC 122. This course uses a computer- based content delivery system (internet, CDROM, etc.) and is designed for students who prefer a self-paced individualized learning environment.

Prerequisite: MATH 162 or MATH 166. Students cannot get credit for both PHYC 122 and PHYC 142.

Course Objectives

This course shares the same general objectives as PHYC 122. As such, it serves as a foundation content course for students majoring or minoring 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 the PHYC 140 and PHYC 142 sequence.

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 that can be accessed by students in an individualized self-paced learning environment. PHYC 142 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 122 (5 credits), incorporates an integrated laboratory. The pair of proposed courses, PHYC 142 (4 credits) and PHYC 143 (1 credit), 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 143 can be taken concurrent with but not prior to PHYC 142). 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. However, online laboratory experiments are currently being developed and they will be available staring the fall semester of 2013. Once they are fully implemented, the student may not need on-campus visits. 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 lecture PHYC 122 course. These include (the list is illustrative, not exhaustive of the topics typically covered):

- Temperature
  - Temperature measurement, thermal expansion
- Calorimetry
  - Specific heat, latent heat, calorimetry without and with change of state, heat capacity
- Heat transfer
  - Conduction, convection, and radiation
- Ideal gases
  - Gas laws, kinetic theory of gases, internal energy of gases, Maxwell distribution of molecular speeds
- Thermodynamics
  - Laws of thermodynamics, thermodynamic processes and ideal gases, state variables and path independence on PV diagrams, Carnot cycle and engine efficiencies, entropy.
- Static electricity
  - Coulomb's law, the electric field, point charges and charge distributions, Gauss' Law, electric potential, equipotential surfaces, capacitance.
- Current electricity
  - Ohm's law, Kirchoffs laws, series and parallel circuits, use of Kirchoffs laws to solve two-loop circuits, RC circuits.
- Magnetic Fields
  - Force on moving charges and on current carrying wire, B-field distributions, permanent magnets, motion of charges in B- fields, torque on current loop
- Sources of B-fields
  - Law of Biot and Savart, Ampere's Law, long straight wire, current loop, solenoid fields.
- Faraday's law
  - Motional EMF, Lenz' law, generators, self-inductance, RL circuits
- Magnetism
  - Diamagnetism, paramagnetism, ferromagnetism, permeability, hysteresis, magnetic field of the Earth
- AC circuits
  - Basic RLC circuit with alternating voltage, reactance, impedance, phase angles, power, resonance, filters.
- Electromagnetic waves
  - Sinusoid electromagnetic waves, Maxwell's equations, energy in em waves, the electromagnetic spectrum
- Geometric optics
  - Reflection, refraction, thin lenses, spherical mirrors, lens and mirror combinations, real and virtual image formation, optical instruments
- Physical optics
  - Interference, single and double slit diffraction, thin films, Newton's rings, diffraction grating, spectroscopy
- Modern Physics (optional)
  - Special relativity theory, Bohr model of the atom, the wave nature of particles, Cosmology
- Methods of evaluating student performance
  - Course grades will be based on the student's performance on homework, three/four semester exams and one final exam. Exam delivery may 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 internet. 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 electronically.

Bibliography