Master Syllabus Department of Physics and Astronomy



PHYC 691 Advanced General Science

Course Description

Further study of the principles of physics, chemistry, meteorology, geology, and astronomy that were introduced in the prerequisites: PHYC 101 (3 credit hours)

Course Objectives

The course is recommended for k-8 teachers of science, but is appropriate for all educators wishing to enhance their knowledge of introductory physics concepts and effective ways to teach them. The student will gain knowledge in the teaching and learning of physics principles, with a primary focus on laboratory activities and conceptual development. This will be accomplished with the use of inexpensive equipment that the student will be trained to make or find.

Course Rationale

Physical science is the study of the principles and concepts of the laws of nature involving mechanical, heat, light, electrical, nuclear, and chemical energy and the conservation laws associated with these forms of energy. This course is designed primarily for inservice teachers with emphasis on applications appropriate to the k-8 classroom, but is open to other inservice teachers. It is a one-semester, three credit hour course that includes both lecture and laboratory sessions. It provides a rapid overview of topics in physics and physical science.

Since one goal of the course is to develop k-12 school science teachers who are knowledgeable in the physical sciences, the National Science Education Standards and the Indiana State Science Standards are used as a guide to the topics covered in the course.

Course Content, Format, and Bibliography

Content

Topics covered in this course may include concepts of:

- Measurement: the metric system, precision of measured quantities
- Properties of Matter: states of matter, density
- 1D Motion: constant and accelerated motion, gravitational acceleration
- 2D Motion: parabolic motion, rotational motion, circular motion
- Forces: Newton's laws of motion, friction, equilibrium, torque and balance
- Mechanical Energy: kinetic energy, gravitational potential energy, elastic potential energy, simple machines, work, power, conservation of mechanical energy
- Momentum and Impulse: elastic and inelastic collisions

- Wave Characteristics and Properties: velocity, frequency, amplitude, wavelength, period, phase, standing waves, reflection, refraction, diffraction, interference
- Sound Waves: sound production, music, speed of sound
- Electromagnetic Radiation: speed of light, frequency, wavelength, polarization, electromagnetic spectrum
- Light: mirrors and reflection, lenses and refraction, diffraction and interference, color
- Static Electricity: Coulomb's law; electric potential difference, historical static devices
- Current Electricity: cells and batteries, resistance, series/parallel/combination circuits, Ohm's law, light bulbs circuits, Kirchhoff's equations
- Magnetism: magnetic fields, magnetic interactions
- Electromagnetism: electromagnets, transformers, motors and generators
- Thermal Energy: heat transfer, changes of state
- Atomic Energy: the atom, radioactivity, nuclear fission and fusion

Format

This course may be offered during the spring and fall semesters, as a five-week summer term course, or as a week-long summer workshop. Sessions will include lecture, discussion, and laboratory work. Student work used to determine the student's course grade may include classwork, homework, laboratory activities and investigations, and research reports.

Bibliography

Conceptual Physics, Paul Hewitt, Publisher: Addison-Wesley

Physics by Inquiry, Volume I by Lillian C. McDermott (1996). ISBN 0471144401

Physics by Inquiry, Volume II by Lillian C. McDermott (1996). ISBN 047114441X

Five Easy Lessons: Strategies for Successful Physics Teaching, Randall D. Knight (2002). ISBN 0-8053-8702-1

Teaching Physics with the Physics Suite, Edward Redish (2003). ISBN 0-471-39378-9

Targeting Students' Science Misconceptions: Physical Science Concepts Using the Conceptual Change Model, Joseph Stepans (2006). ISBN 1-891022-07-5