PHY 1007

Physics with Medical Applications

Course Description

PHY 1007 Physics with Medical Applications (3) P

This is a one semester course for health-related majors, primarily those entering Santa Fe College's Nuclear Medicine, Physical Therapist Assistant, or Diagnostic Medical Sonography programs. It is a survey of topics in physics related to the health field, including applications of physics to principles of mechanics, heat, light, sound, electricity and magnetism, and radioactivity. This is a transferrable course.

Prerequisite: none

Rationale

In a technological and free society, the individual is summoned to make decisions on specific uses of technologies related to physical principles. Making those decisions in a comprehensive and discerning manner requires some knowledge of fundamental physical laws and interactions. This course is offered to introduce students to crucial concepts in physics and how they apply to contemporary life, health and wellness. The course covers a broad range of basic physics concepts in the context of the human body and movement. Making appropriate decisions related to patient care requires knowledge of fundamental physics. Accordingly, this course uses a unifying theme of homeostatic interrelationships and system connections to present the basic concepts of biology and physiology and their application to everyday life.

This course supports the mission of the College to enrich the lives of our students and the community as a whole and it supports the mission of Sciences for Health Programs, which is to prepare students to succeed in the Allied Health Programs and to make reasonable health and wellness decisions for themselves and their families.

Impact Assessment

This course deals with topics that are physiological and biological in nature, but which are vital for our society's overall health and wellness. Thus it is important for community colleges to support the acquisition of essential concepts in the functioning of the human body as well as relate these to important contemporary lifestyle and wellness issues. Integration with other disciplines such as other physical sciences and biology is expected to occur naturally in discussion of societal and health issues that are related to physics.

Broad Course Objectives

Major Topics/ Concepts/ Skills/ Issues

- Mechanics: General Concepts (units and measurements; mass, density, volume; position, velocity and acceleration; forces and torques; equilibrium; mechanical energy and conservation of energy)
- Mechanics of Solids and Fluids (pressure; elasticity; compliance; bulk modulus; fluids in motion; viscosity; fluidics and Coanda effect)
- Thermodynamics (temperature, heat, phases and phase transitions; first law of thermodynamics; ideal gas laws; real gases)

- Sound (sound as a wave, Doppler effect; absorption, reflection, and scattering of sound; isotropic and collimated sound waves and sonic pulses)
- Electric Current, Electric Circuits, and Magnets (charges and ions; basic DC circuits; Ohm's Law; bridges; AC circuits and elements of electronics; basics of magnetism)
- Electromagnetic Radiation (electromagnetic waves and photons; electromagnetic spectrum; radio waves; visible light; elements of geometrical optics; lasers; X-rays)
- Elements of Nuclear Physics (isotopes; radioactive decay; spin, NMR and MRI)

Course Outline with Specific Objectives

This course is designed to address the following learning objectives:

1. Concepts and laws of mechanics
   - Concepts of forces and torques, velocity and acceleration, energy;
   - Stability of static and dynamic systems;
   - Mechanics of pressure, fluid flow and equilibria;
   - Elasticity, stress and strain, shear and bending effects;
   - Related measurement methodology and the interpretation of measurement.

2. Principles of thermal system and thermodynamics with applications
   - Temperature and heat, heat transfer and thermal equilibrium, laws of thermodynamics and applicability in human body;
   - Thermal conductivity, convection and radiation processes;
   - Measurement methods.

3. Acoustic systems with applications
   - Wave properties and Doppler effect;
   - Absorption, scattering, reflection;
   - Application of properties in diagnostic systems, ultrasound systems.

4. Electronics for diagnostics and control systems
   - Electronic devices and their interaction with electrical processes in human body;
   - Use of the interaction in diagnostic equipment;
   - Usage of electronics in measurements and control systems for medical applications.

5. Effects of magnetic field, electromagnetic radiation and radioactivity
   - Basic principle of magnetic field and interaction with equipment used in medical application;
   - Principles of electromagnetic radiation – human interaction in different spectrum bands – including microwave, laser (visible range), X-rays and gamma rays;
   - The concept of magnetic resonance in diagnostic equipment – NMR, MRI.

6. Interpretation and accuracy of measurement methods in different areas
   - Interpretation of measurement based on measurement methodologies;
   - Error estimation on the basis of accuracy of measurement methods;
   - Using evidential methods for diagnostic purposes.

Evaluation

3-5 unit exams

Final Exam (cumulative)