Print Date: 8/6/14

Course Objectives/Course Outline
Spokane Community College

Course Title: **Fundamentals of Medical Physics**
Prefix and Course Number: **PHYS 120**

Course Learning Outcomes:
By the end of this course, a student should be able to:

- Describe and apply scientific method.
- Define velocity, acceleration, force, work, potential energy, kinetic energy pressure, area, volume, mass density, weight density, center of gravity, and specific gravity with correct units in both the Sl and English systems of units.
- Plot and interpret graphs to determine physical quantities and relationships between variables.
- Convert between different systems of units specifically (SL and English)
- State and apply newton's three laws of motion to various situations some of which involve vector addition.
- Describe the condition for mechanical equilibrium and work problems to determine forces or torques required for mechanical equilibrium.
- Describe and calculate centripetal force.
- State and explain conservation of energy.
- Calculate work, power, and energy for various situations.
- Describe mechanical advantage, efficiency, and apply to problems involving simple machines
- State and give examples of principles related to static fluids and their applications to the human body. Specifically Pascal's and Archimedes' Principles and determination of the buoyant force on an object immersed in a fluid.
- Define diffusion, osmosis, dialysis, osmotic pressure, hydrostatic pressure, capillary action, surface tension, and viscosity.
- Explain significance of isotonic and near-isotonic solutions for injection into the blood.
- Describe different types of waves and physical parameters associated with wave motion.
- Define and give examples of standing waves and resonance.
- Define elasticity and how it relates to wave motion.
- Explain the procedure used to produce ultrasound images using transducers and the different scanning formats used to produce images.
- Explain how the Doppler effect is used in Doppler ultrasound.
- Compare continuous and pulsed ultrasound.
- Describe how echoes and attenuation from interaction of the signal with tissue and bone affect the ultrasound signal.
- List factors that determine detail resolution and differentiate between the two aspects of detail resolution.
- List and describe function of sonographic instruments used to form, store, process, and display images as well as the different display modes.
- Describe fluid flow and resistance to flow.
- Describe how two-dimensional flow is displayed color-coded on the sonographic display and how the Doppler shift and Doppler-power displays are different.

Course Outline:

I. Measurement and the Scientific Method
   A. The Role of the Experiment
   B. Measurement
   C. Accuracy and Significant Digits

D. Scientific Notation
E. Conversion of Units

II. The Description of Motion
A. Velocity and Acceleration
B. Acceleration of Gravity
C. Motion with Constant Acceleration
D. Graphical Description of Motion

III. The Causes of Motion
- A. Newton's Laws
- B. Forces as Vectors
- C. Applications of Vectors
- D. The Force of Gravity
- E. Mass, Weight, and Density
- F. Weightlessness
- G. Equilibrium and Torques
- H. Clinical Applications of Gravity
- I. Circular Motion
- J. Clinical Applications of Circular Motion
- K. Frictional Forces

IV. Work, Energy, and Machines
- A. Work
- B. Energy
- C. Conservation of Energy
- D. Power
- E. Principles of Machines
- F. Simple Machines

V. The Properties of Liquids
- A. Liquid State
- B. Definition of Pressure
- C. Pressure in Liquids
- D. Distribution of Pressure in a Statis Liquid
- E. Transmission of Pressure: Pascal's Principle
- F. Clinical Applications of Pascal's Principle
- G. Buoyant Force and Archimedes' Principle

VI. Molecular Phenomena Related to Biological Processes
- A. The Kinetic Energy of Molecules
- B. Diffusion
- C. Osmosis
- D. Dialysis
- E. Transport Across Living Membranes
- F. Laws of Gas Transport
- G. Transport of Respiratory Gases
- H. Cohesion and Adhesion
- I. Surface Tension and Respiration
- J. Capillary Action
- K. Viscosity
- L. Adsorption and Absorption

VII. Elasticity and Wave Motion
- A. Elasticity
- B. Periodic Motion and Resonance
- C. Traveling Waves
- D. Wave Properties of Sound and Light
- E. Energy in Waves
- F. Interference and Standing Waves
- G. Doppler Effect Ultrasonic Sound
- H. Nuclear energy

VIII. Ultrasound
- A. Sonography

- B. Doppler Ultrasound
- C. Sound Pulsed Ultrasound
- D. Attenuation
- E. Echoes

IX. Transducers
- A. Construction and Operation
- B. Beams and Focusing
- C. Automatic Scanning
- D. Detail Resolution

X. Imaging Instruments
- A. Beam focuser
- B. Signal Processor
- C. Image Processor
- D. Display

XI. Doppler Effect
- A. Flow
- B. Stenoses

XII. Color-Doppler Instruments
- A. Color-Doppler Principle
- B. Instruments
- C. Doppler-shift Displays
- D. Doppler-Power displays