HIBBING COMMUNITY COLLEGE
COURSE OUTLINE

COURSE NUMBER & TITLE: PHYS 2010 - General Physics 1
CREDITS: 5 (4 Lec/ 1 Lab)
PREREQUISITES: Corequisite MATH 2101: Calculus 1

CATALOG DESCRIPTION:
General Physics 1 is the first course in the physics sequence for students majoring in physical science or engineering, as well as liberal arts studies. This course focuses on the study of mechanics of particles and rigid bodies including kinematics, dynamics, conservation laws, linear momentum, and angular momentum. In addition the topics of fluid mechanics and mechanical waves are covered. Laboratory is included. MNTC Goal Area: (3) Natural Sciences.

OUTLINE OF MAJOR CONTENT AREAS:

I. One-dimensional motion
   - A. Position and displacement
   - B. Velocity
   - C. Acceleration
   - D. Graphical representation of one-dimensional motion
   - E. Motion in one dimension with constant acceleration
   - F. Free fall

II. Vectors
   - A. Vector arithmetic
   - B. Components of a vector
   - C. Multiplication of vectors

III. Motion in two and three dimensions
   - A. Position and displacement
   - B. Velocity
   - C. Acceleration
   - D. Motion with constant acceleration
   - E. Motion of a projectile
   - F. Circular motion

IV. Forces on Particles
   - A. Newton's First Law
   - B. Newton's Second Law
   - C. Newton's Third Law
   - D. Newton's Law of Universal Gravitation
   - E. Surface contact forces
   - F. Spring force

- G. Applications of Newton's Laws

V. Work and mechanical energy
- A. Work done by a constant force
- B. Work done by a variable force
- C. Work-energy theorem for a particle
- D. Conservative forces and potential energy
- E. Conservation of mechanical energy
- F. Mechanical energy and the presence of nonconservative forces
- G. Power

VI. Momentum
- A. Introduction to momentum
- B. Impulse
- C. Conservation of momentum
- D. Elastic collisions
- E. Inelastic collisions

VII. Rotational mechanics I
- A. Rotational kinematics
- B. Center of mass
- C. Moment of inertia
- D. Torque
- E. Dynamics of fixed-axis rotation
- F. Rotational work and kinetic energy
- G. Fixed-axis rotation and the conservation of mechanical energy

VIII. Angular motion and momentum
- A. Rolling motion
- B. Angular momentum of a particle
- C. Angular momentum of a system of particles
- D. Angular momentum of a rotating rigid body
- E. Conservation of angular momentum

IX. Equilibrium of a rigid body
- A. Conditions of equilibrium
- B. Examples involving systems in equilibrium

X. Oscillatory motion
- A. Simple harmonic motion
- B. Equations of simple harmonic motion
- C. Parameters of simple harmonic motion
- D. A simple pendulum
- E. A physical pendulum

XI. Mechanical waves
- A. Types of waves
- B. Wave speed
  1. Speed of a transverse wave pulse on a string
  2. Speed of a longitudinal wave pulse in a fluid
- C. Harmonic waves
- D. Energy transport in harmonic waves
- E. Circular and spherical waves

F. Plane-wave approximation

XII. Sound waves
- A. Principle of superposition
- B. Superposition of two harmonic waves of the same frequency
- C. Beats
- D. Doppler Effect
- E. Standing waves
- F. Standing waves in materials

XIII. Fluid mechanics
- A. States of matter
- B. Density and pressure
- C. Pressure variation with depth
- D. Measurement of pressure
- E. Archimedes' Principle
- F. The equation of continuity
- G. Bernoulli's equation

COURSE GOALS/OBJECTIVES/OUTCOMES:

The student will

1. perform vector computations.
2. apply kinematic equations to solve motion problems.
3. utilize Free Body Diagrams and Mass Accelerations Diagrams to solve dynamics kinetics problems.
4. apply the general energy equation to solve work and conservation of energy problems.
5. perform rotational mechanics analysis.
6. apply the principle of conservation of momentum to analyze impacts and collision.
7. perform oscillatory motion analysis.
8. use the equations of fluid mechanics to analyze static and dynamic fluid systems.
9. use wave equations to analyze mechanical waves.
10. perform assigned laboratories in a team environment.
11. complete an extensive capstone design project in a team environment and submit a professional report.
12. communicate all written work in a professional manner utilizing spreadsheets and word processing applications.

MNTC GOALS AND COMPETENCIES MET:

Natural Sciences

HCC COMPETENCIES MET:

Thinking Creatively and Critically

STUDENT CONTRIBUTIONS:
The student will attend class regularly, participate in class discussion, complete assignments, team laboratory or design projects, and take a comprehensive final examination. The student will spend sufficient time to complete all assignments.

METHODS FOR EVALUATING STUDENT LEARNING:
The final grade is determined by grades earned on homework problems, periodic examinations, a comprehensive design project, laboratory reports, and a comprehensive final.

SPECIAL INFORMATION: (SPECIAL FEES, DIRECTIVES ON HAZARDOUS MATERIALS, TEXTBOOK USED, ETC.)
A scientific calculator with exponential and logarithmic capabilities is required for this course.

AASC APPROVAL DATE: November 6, 2007

REVIEW DATE: November 2012