College Of DuPage **Implementation Date:** Fall/05

ACTIVE COURSE FILE

B. *Curricular Area: Physics Course Number: 1201

Course Title: General Physics I

Semester Credit Hours: 5 Lecture Hours: 4 Lab Hours: 2 Clinical Hours: 0

*Changes from the present course must be accompanied by a yellow Course Revision or Deletion Form.

Course description to appear in catalog:

> Algebra and trigonometry-based study of classical linear and rotational kinematics and dynamics, including work, energy, impulse, momentum, collisions, periodic motion, and wave motion.

Prerequisite: A grade of C or better in Math 1432 or Math 1218 or equivalent

A. General Course Objectives

Upon successful completion of this course the student should be able to do the following:

1. Analyze equation solutions for correctness based on unit mathematics
2. Describe the relationships among different units of measure
3. Interpret and explain the relationships among an object's displacement, velocity, and acceleration in multiple dimensions
4. Calculate the effect of external forces on an object's motion using Newton's Laws in multiple dimensions
5. Create and label simple free-body diagrams in two dimensions
6. Explain and apply the relationship between work and energy
7. Calculate the effect of external forces on an object's motion using work-energy methods in the case of both conservative and non-conservative forces in multiple dimensions
8. Identify and calculate the different forms of energy in classical dynamics (potential, kinetic, and mechanical)
9. Calculate the effect of both static and kinetic friction on the motion of an object using both direct force/acceleration methods and work/energy methods
10. Calculate the effect of external and internal forces on an object's motion using impulse and momentum methods in multiple dimensions
11. Formulate the outcome of collisions of particles in both elastic and inelastic cases
12. Calculate the motion of a system of particles using center-of-mass methods
13. Interpret and explain the relationships among an object's rotational displacement, velocity, and acceleration
14. Create and label simple free-body diagrams for rotational situations
15. Formulate the effect of external torques on an object's motion using Newton's laws in rotational form
16. Formulate the resultant forces for simple objects in static equilibrium

17. Calculate kinematic characteristics of an object undergoing simple harmonic motion using the equations of motion for force, position, velocity, and acceleration
18. Determine pressure in a static and dynamic fluid
19. Apply Archimedes' principle to determine buoyant forces
20. Explain the differences among heat, temperature, and internal energy
21. Explain the concept of the ideal gas model and its predictions
22. Predict the amount of energy transferred during different types of phase transitions
23. Interpret and explain the concept of entropy and the second law of thermodynamics
24. Calculate thermal efficiencies and coefficients of performance
25. Interpret the motion of a sinusoidal wave and explain the superposition principle
26. Formulate the kinematic characteristics of a sinusoidal wave based on data in both graphical and numerical form
27. Calculate the resonant frequencies and wave lengths for both transverse and longitudinal waves given physical information about the situation
28. Apply the superposition principle to calculate positions of maximum destructive and constructive interference for waves
29. Calculate sound wave intensities and intensity levels given physical information about the situation
30. Calculate Doppler shifts and beat frequencies

B. Topical Outline

1. General measurement
   a. Units of measurement
   b. Change of units and compound units
   c. Addition and subtraction of vectors

2. One dimensional motion
   a. One dimensional kinematics--position, velocity, acceleration
   b. Average and instantaneous kinematics
   c. Relationships among kinematic variables
   d. Special cases of constant velocity and constant acceleration

3. Motion in two dimensions
   a. Position, velocity, and acceleration as vectors
   b. Two dimensional kinematics
   c. Projectile motion

4. Force and motion
   a. Dynamics and Newton's laws of motion
   b. Inertial mass
   c. The linear superposition principle
   d. Applications of Newton's laws
5. Rotational motion
   a. Uniform circular motion
   b. Centripetal acceleration
   c. Radial and tangential components of acceleration
   d. Satellite motion

6. Energy and work
    a. The work-energy theorem
    b. Calculation of work done by different forces
    c. Applications of the work-energy theorem
    d. Conservative and non-conservative forces
    e. Power
    f. Conservative and non-conservative forces and potential energy
    g. Gravitational and spring potential energies
    h. Conservation of mechanical energy
    i. Applications of energy conservation
    j. Graphical representation of energy conservation

7. Collisions and impulse
    a. The impulse-momentum theorem for one and two or more particles
    b. Net impulse, internal forces and momentum conservation
    c. Vector momentum conservation
    d. Applications of momentum conservation
    e. Measurement and calculation of center of mass position
    f. The velocity and acceleration of the center of mass
    g. Elastic and inelastic collisions
    h. The ballistic pendulum

8. Rotational kinematics
    a. Rotational displacement
    b. Rotational velocity and acceleration
    c. Rolling motion

9. Rotational dynamics
    a. Simple applications of particle rotational dynamics
    b. Rotational dynamics for a rigid object
    c. Definition of moment of inertia
    d. Applications of rotational dynamics
    e. Rotational kinetic energy and energy conservation
    f. Angular momentum conservation

10. Harmonic motion and elasticity
    a. Hooke's law
    b. Simple harmonic motion
    c. Motion of a pendulum
    d. Damped and forced harmonic motion
    e. Stress and strain

11. Fluids
    a. Density and pressure
    b. Pascal’s principle
    c. Archimedes’ principle
    d. Bernoulli’s equation

12. Temperature and heat
    a. Definition of temperature and different temperature scales
    b. Definition and units of heat
    c. Temperature versus heat
    d. Mass and molar specific heats
    e. Thermal expansion
    f. Change of state

13. Kinetic theory of gases
    a. First law of thermodynamics
    b. Ideal gas law
    c. Methods of heat transfer (conduction, convection, and radiation)

14. Entropy and the second law of thermodynamics
    a. Cycles, heat engines and refrigerators
    b. Efficiency of a heat engine
    c. Carnot heat engine and Carnot cycle
    d. Second law of thermodynamics
    e. Definition of entropy

15. Oscillations
    a. Hooke's Law and simple harmonic motion
    b. Examples of simple harmonic motion
    c. Damped and forced harmonic motion

C. Methods of Evaluating Student:

Students will be evaluated using a combination of grades from homework, quizzes, and tests along with assessment of lab methods.

Initiator Date

Division Dean Date

Sponsor Date

PHY1201
tgc:04/12/04