Cape Cod Community College

Prepared by Department of Natural Sciences & Applied Technology
Date of Departmental Approval: February 15, 2017
Date Approved by Curriculum and Programs: February 22, 2017   Effective: Fall 2017

1. Course Number: **PHY 151 and PHY 151L**
   Course Title: **Physics I and Physics I Laboratory**

2. Description: First semester of a two-semester introduction to college physics without calculus. This course covers mechanics (kinematics, dynamics and statics), relativity and some heat. The course is appropriate for any student interested in science and particularly appropriate for health sciences and pre-professional students. (3 class hours / 2 laboratory hours)

3. Student Learning Outcomes:
  Upon successful completion of this course, students are able to do the following:
   - Describe the scope of the field of Physics and its basic historical development.
   - Effectively utilize appropriate quantities and units to describe physical phenomena.
   - Use a variety of devices and instruments in taking laboratory measurements.
   - Use appropriate techniques in the laboratory, collect and analyze meaningful data, and present clearly and cogently written laboratory results (utilizing Standard American English).
   - Use word processing and spreadsheet software to prepare and present laboratory reports.
   - Use a scientific calculator as a tool in solving a wide variety of problems.
   - Work cooperatively in a small group setting to complete various laboratory exercises, following the written instructions provided.
   - Define, compare and contrast displacement (distance), velocity (speed), and acceleration.
   - State and interpret Newton's three laws of motion.
   - Describe and discuss circular motion and projectile motion.
   - Explain the basic principles of statics (equilibrium mechanics).
   - Describe the gravitational field (locally and universally), and explain the dynamics of orbiting bodies.
   - Define work, energy, power and momentum.
   - Discuss conservation of energy and conservation of momentum.
   - Solve (using algebra and trigonometry as tools) almost all "one concept" problems presented that involve any of the topics included in this course.
   - Solve (using algebra and trigonometry as tools) most "two concept" problems from the same list of topics.
   - Explain some of the ways in which Physics can be applied to the problems of society in general.

4. Credits: Four credits

5. Satisfies General Education Requirement: Natural or Physical Science

6. Prerequisite: MAT040 (Intermediate Algebra) or MAT110 (Algebra for Precalculus) or MAT035 (Algebra for Non-STEM), ENL108 (Critical Reading & Thinking) or satisfactory basic skills assessment scores

7. Semesters Offered: Fall, Summer

8. Suggested General Guidelines for Evaluation: Course grading procedures and make-up policies are detailed in a student handout. In summary, 75% of the course grade evaluation is based on achievement in the lecture portion of the course, while 25% is based on the laboratory portion of the course.

9. General Topical Outline: See attached.

PHY 151. PHYSICS I Content Outline

Mechanics, relativity, and (some) heat.

I. Fundamentals of Mechanics
- A. Introduction
  - 1. History and Philosophy
  - 2. Units and Measurement
- B. Vectors
  - 1. Definitions
  - 2. Addition and subtraction of vectors
    - a. Graphically
    - b. Analytically
  - 3. An application - summing forces
- C. Kinematics - motion considering neither force nor mass
  - 1. Definitions - distance, displacement, speed, velocity, acceleration
  - 2. Uniform linear motion
  - 3. Free-fall (Galileo)
- D. 2-dimensional motion - projectiles
- E. Newton's laws of motion - dynamics
  - 1. Isaac Newton
  - 2. Inertia
  - 3. Acceleration is proportional to force and inversely proportional to mass
  - 4. Action - reaction
  - 5. Applications of the second law (friction)
- F. Gravitation
  - 1. Newton's universal law of gravitation
  - 2. Forces and Fields - the four fundamental forces
- G. Orbital Motion
  - 1. Uniform circular motion
  - 2. Kepler's Laws
  - 3. Orbits in atoms

II. Mechanics - further considerations
- A. Work and energy
  - 1. Definitions - work, energy (kinetic and potential), and power
  - 2. Conservation laws and conservation of energy
  - 3. Work by a non-constant force
- B. Momentum
  - 1. Linear momentum and impulse (a restatement of Newton's second law)
  - 2. Conservation of linear momentum
  - 3. Collisions and recoils
- C. Rotational kinematics and dynamics
  - 1. Angular measurement, velocity, and acceleration
  - 2. The equations - the linear-rotational analogy
  - 4. Torque, angular acceleration, and moment of inertia
- D. Equilibrium
- E. Relativity
  - 1. Development of Special Relativity
  - 2. Consequences of Special Relativity
  - 3. Brief summary of General Relativity

III. Heat and Thermodynamics (these topics will be covered in laboratory only)
- A. Temperature
  - 1. Absolute zero
  - 2. Ideal gas law
- B. Heat and heat transfer
- C. Calorimetry