Prepared by the 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: PHY211 and PHY211L**
   Course Title: University Physics I and University Physics I Laboratory

2. **Description:** First semester of a two-semester introduction to university physics. This course covers mechanics (kinematics, dynamics, and statics), relativity and some heat. The course is appropriate for math, science, and engineering students. Calculus will be used. (3 class hours / 1 recitation hour / 2 laboratory hours) *Previous experience in physics (such as PHY 106) is strongly recommended. Students must have taken, or be currently enrolled in Calculus I (MAT 240).*

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) including some error analysis.
   - 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) all "one concept" problems presented that involve any of the topics included in the outline for this course.
   - Solve (using algebra, trigonometry and - occasionally- calculus as tools) almost all "two and three concept" problems from the same list of topics.
   - Solve (using algebra, trigonometry and - occasionally - calculus as tools) some "many 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:** MAT195 (Pre-Calculus with Trigonometry) or satisfactory basic skills assessment score; **Co-requisite:** ENL101 (English Composition I) and MAT240 (Calculus I)

7. **Semester(s) Offered:** Varies

8. **Suggested General Guidelines for Evaluation:** Grades will be based on homework; class work; one-hour tests; laboratory work and reports; and a final examination.

9. **General Topical Outline:** See attached.

PHY211 and PHY211L. University Physics I and University Physics I Laboratory

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 force
  - 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
    3. 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