Effective Implementation date: FALL 2018, 201830

Required Syllabus Information – all must be included in the course syllabus

PHY111
Course Title: Physics Alg-Based I/Lab: SC1
Course Credits: 5
Course Description: Covers the physics of mechanics and requires application of classical physics to both mathematical and conceptual problems. Major topics include kinematics in one and two dimensions, Newton's Laws, circular motion, work and energy, impulse and momentum, and rotational mechanics. This course may also include topics relating to simple harmonic motion and traveling and standing waves. This is a statewide Guaranteed Transfer course in the GT-SCI category.

GT Pathways Requirements:
Guaranteed Transfer (GT) Pathways Course Statement:
The Colorado Commission on Higher Education has approved PHY111 for inclusion in the Guaranteed Transfer (GT) Pathways program in the GT- SC1 category. For transferring students, successful completion with a minimum C– grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to https://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html.

GT-SC1: NATURAL & PHYSICAL SCIENCES CONTENT CRITERIA
Students should be able to:

1. The lecture content of a GT Pathways science course (GT-SC1):
    a. Develop foundational knowledge in specific field(s) of science.
    b. Develop an understanding of the nature and process of science.
    c. Demonstrate the ability to use scientific methodologies.
    d. Examine quantitative approaches to study natural phenomena.

2. The laboratory (either a combined lecture and laboratory, or a separate laboratory tied to a science lecture course) content of a GT Pathways science course (GT-SC1):
    a. Perform hands-on activities with demonstration and simulation components playing a secondary role.
    b. Engage in inquiry-based activities.
    c. Demonstrate the ability to use the scientific method.
    d. Obtain and interpret data, and communicate the results of inquiry.
    e. Demonstrate proper technique and safe practices.

GT-SC1 COMPETENCIES & STUDENT LEARNING OUTCOMES

Competency: Inquiry & Analysis:
Students should be able to:

4. Select or Develop a Design Process

a. Select or develop elements of the methodology or theoretical framework to solve problems in a given discipline.

5. **Analyze and Interpret Evidence**
    a. Examine evidence to identify patterns, differences, similarities, limitations, and/or implications related to the focus.
    b. Utilize multiple representations to interpret the data.
6. **Draw Conclusions**
    a. State a conclusion based on findings.

Competency: Quantitative Literacy:

Students should be able to:

1. Interpret Information
    a. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
2. Represent Information
    a. Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).

REQUIRED COURSE LEARNING OUTCOMES

1. Produce both numerical and symbolic solutions to problems using the techniques of algebra, trigonometry, and the concepts of classical physics.
2. Apply physics concepts and equations to real-world problems and design challenges.
3. Design scientific experiments, collect and analyze data, and draw conclusions.
4. Communicate the ideas of classical physics both in everyday language and in the language of mathematics.
5. Explain the difference between scalars and vectors and apply scalar and vector concepts to a variety of real-world problems.
6. Identify and interpret the kinematic variables of displacement, velocity, and acceleration.
7. Analyze, apply, and calculate, in both one and two dimensions, results using the kinematics equations derived from constant acceleration.
8. Analyze, apply, and calculate, under equilibrium and non-equilibrium conditions, results using Newton's Laws.
9. Summarize the conditions that define uniform circular motion (UCM).
10. Apply UCM concepts in calculating centripetal acceleration, velocity, and forces on an object.
11. Define work as the combination of force applied through a distance.
12. Analyze, apply, and calculate various results based on the Work-Energy Theorem.
13. Analyze, apply, and calculate various results based on the conservation or non-conservation of total mechanical energy.
14. Demonstrate an understanding of the relationship between impulse and momentum and how the absence of external forces on a system leads to the conservation of linear momentum.
15. Analyze, apply, and calculate, in one and two dimensions, various results based on the conservation of linear momentum.
16. Identify and interpret the rotational kinematic variables of angular displacement, angular velocity, and angular acceleration.
17. Analyze, apply, and calculate various results using the rotational kinematics equations derived from constant angular acceleration.

18. Analyze, apply, and calculate, under equilibrium and non-equilibrium conditions, various results in a rotational dynamics context.
19. Compare and contrast rotational work and energy to linear work and energy and the conservation of linear momentum to conservation of angular momentum.

REQUIRED TOPICAL OUTLINE

The required topical outline information MUST be included in the syllabi. It may be incorporated using one of the following variations: copying the topical outline as written below, integrating the topics within the assignment schedule, or listing the topics to be covered.

I. Mathematical Concepts
   a. Units
   b. Trigonometry
   c. Scalars and vectors
   d. Vector manipulation

II. Kinematics (One Dimension)
   a. Displacement
   b. Speed versus velocity
   c. Acceleration
   d. Kinematic equations for constant acceleration
   e. Free falling bodies

III. Kinematics (Two Dimensions)
   a. Displacement, velocity, acceleration in two dimensions
   b. Kinematic equations in two dimensions
   c. Projectile motion
   d. Relative velocity

IV. Newton's Laws
   a. Force and mass
   b. Newton's First Law
   c. Newton's Second Law
   d. Newton's Third Law
   e. Vector nature of Newton's Second Law
   f. Gravitational force
   g. Normal force
   h. Static and frictional forces
   i. Equilibrium applications of Newton's laws
   j. Non-equilibrium applications of Newton's laws

V. Circular Motion
   a. Uniform circular motion
   b. Centripetal acceleration

VI. Work and Energy
   a. Work done by a constant force
   b. Work-Energy Theorem and kinetic energy
   c. Gravitational potential energy
   d. Conservative versus non-conservative forces
   e. Conservation of total mechanical energy
   f. Power

VII. Impulse and momentum
   a. Impulse Momentum Theorem
   b. Conservation of linear momentum
   c. Collisions in one dimension
   d. Collisions in two dimensions
   e. Center of mass

VIII. Rotational Kinematics
   a. Angular displacement, velocity, and acceleration
   b. Equations of rotational kinematics
   c. Angular and tangential variables
   d. Angular and tangential acceleration

IX. Rotational Dynamics
   a. Forces and torques on rigid objects
   b. Rigid objects in equilibrium
   c. Rotation about a fixed axis
   d. Rotational work and energy
   e. Angular momentum

RECOMMENDED TOPICAL OUTLINE:

I. Simple Harmonic Motion
   a. The spring-mass sytem
   b. Energy and simple harmonic motion

II. Waves
   a. Nature of waves and the traveling wave equation.
   b. Superposition of waves

III. Standing waves

Syllabi requirements, including legal compliance information must be included. Individual College syllabi guidelines may include additional information. Please contact your VPI/CAO for specific College requirements.