Miami Dade College

Course Description

PHY2048 | Physics with Calculus 1 | 4.00 credits

This calculus-based course serves as the first in a two-part series, covering topics like kinematics, dynamics, energy, momentum, rotational motion, fluid dynamics, oscillatory motion, and waves. Designed for science and engineering majors, the course integrates critical thinking, analytical skills, and real-world applications. Student learning outcomes: students will solve analytical problems describing different types of motion, including translational, rotational, and simple harmonic motion; students will apply newton's laws, and conservation laws to solve analytical problems of mechanics; students will identify and analyze relevant information presented in various formats such as graphs, tables, diagrams, and/or mathematical formulations; and students will solve real-world problems using critical thinking skills and knowledge developed from this course. Prerequisites: High school physics or PHY1025, PHY 2053 or departmental approval and MAC2311; corequisite: PHY2048L. Special fee.

Course Competencies:

Competency 1: The student will demonstrate an understanding of the scientific method by:

1. Explaining how the scientific method differs from the day-to-day application of observation, generalization, and prediction

Competency 2: The student will demonstrate an understanding of basic kinematics by:

1. Explaining the difference between average and instantaneous velocity or acceleration
2. Applying techniques from calculus to calculate the velocity and acceleration of an object when the position is given as a function of time
3. Using kinematics equations to calculate later position and velocity for an object undergoing constant acceleration in one or two dimensions
4. Using the Galilean formulas to transform a velocity or acceleration from one reference frame to another
5. Calculating centripetal acceleration for an object moving in a circle

Competency 3: The student will demonstrate an understanding of translational dynamics and gravity by:

1. Sketching a "free body" diagram to represent the forces acting on a system of masses
2. Expressing static or kinetic friction in terms of the normal forces
3. Writing and solving a set of component force equations for each mass in the system
4. Calculating the properties of a circular orbit

Competency 4: The student will demonstrate an understanding of the concepts of work and energy by:

1. Using integration to calculate the work that a force does on a moving object
2. Calculating the power which a force supplies to a moving object

Competency 5: The student will demonstrate an understanding of the concepts of momentum and center of mass by:

1. Locating the center of mass of an object or a system of objects
2. Finding the momentum change resulting from an impulse
3. Solving collision problems using conservation of momentum in one or two dimensions

Competency 6: The student will demonstrate an understanding of rotational quantities by:

1. Using the equations of rotational kinematics to calculate a later angular position and angular velocity for an object undergoing a constant angular acceleration
2. Calculating the moment of inertia fora symmetrical object
3. Finding the resultant torque caused by one or more forces acting on an object

4. Find the acceleration of a rotating object subject to torques
5. Find the kinetic energy of a rotating system
6. Solving a collision problem involving angular momentum

Competency 7: The student will demonstrate an understanding of the behavior of solids and fluids by:

1. Applying equations of stress and strain
2. Finding the force generated by pressure at a given depth in a fluid
3. Solving statics problems involving buoyancy
4. Applying Bernoulli's equation to fluid flow

Competency 8: The student will demonstrate an understanding of harmonic motion by:

1. Finding the angular frequency and period of oscillation for a mass subject to a linear restoring force
2. Finding the position, velocity, acceleration, and energies as functions of time for an object undergoing simple harmonic motion

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information