J. Sargeant Reynolds Community College
Course Content Summary

Course Prefix and Number: PHY 241 **Credits: 4**

Course Title: University Physics I

Course Description:

Covers classical mechanics and thermodynamics. Includes kinematics, Newton's laws of motion, work, energy, momentum, rotational kinematics, dynamics and static equilibrium, elasticity, gravitation, fluids, simple harmonic motion, calorimetry, ideal gas law, and the laws of thermodynamics. Part I of II. This is a UCGS transfer course. Prerequisite: MTH 263 with a grade of C or better. Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week. 4 credits.

General Course Purpose:

PHY 241 is a first semester of a two-semester calculus-based introductory physics with laboratory sequence. It provides the student with a broad understanding of the general concepts and principles of the physical universe, and prepares the student for advanced study s: Upon completing the course, the student will be able to:

Measurements, Units and Vectors

units

- Differentiate between scalar and vector quantities
- Define vectors using unit vectors
- Add and subtract vectors graphically and by component resolution
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Newton's Laws of Motion

- Explain Newton's three laws of motion
- Differentiate among mass, weight and apparent weight
- Draw free-body diagrams for a given physical system
- Describe general characteristics of static and kinetic friction
- Apply Newton's laws to a variety of systems including multiple bodies undergoing linear or uniform and non-uniform circular motions involving horizontal, vertical and inclined planes, strings, and pulleys

Work and Energy

- Define and calculate work done by a constant force and by a variable force
- Calculate work done by a force from force vs position graphs
- Define kinetic energy, gravitational potential energy near the Earth's surface and elastic potential energy
- Distinguish between conservative and non-conservative forces
- Apply Work-Energy principle and conservation of mechanical energy principle
- Define and calculate power

Collision and Linear Momentum

- Define and calculate linear momentum and impulse
- State the condition for conservation of momentum
- Define elastic, inelastic and completely inelastic collisions
- Apply conservation of momentum and conservation of momentum in conjunction with the conservation of energy to systems in 1-D and 2-D collision and explosion
- Define and calculate center-of-mass of a system of many point masses as well as for bodies with continuous distribution of mass

Kinematics and Dynamics of Extended Body Undergoing Rotation and Elasticity

- Define and calculate angular displacement, average angular velocity, and average angular acceleration
- Differentiate between average and instantaneous quantities
- Relate linear and angular quantities to each other
- Define and calculate moment of inertia and rotational kinetic energy
- Find the moment of inertia of an extended body about an axis of rotation
- Apply conservation of energy to rotating rigid bodies
- Define and calculate torque and angular momentum
- Apply Newton's laws of motion to rotational systems
- Apply the conservation of angular momentum principle to rotational systems
- Explain and apply the conditions of static equilibrium
- Define and calculate different types of strain, stress, and modulus

Gravitation

- Explain Newton's law of gravitation
- Calculate the gravitational force between objects
- Define and calculate gravitational potential energy
- Calculate the velocity and period of a satellite in a circular orbit
- Explain Kepler's laws of planetary motion

Oscillatory Motion

- Define oscillation and mathematically describe simple harmonic motion
- Define amplitude, frequency, period and phase of Simple Harmonic Motion (SHM)
- Apply conservation of energy principle in a simple harmonic motion
- Application of SHM to simple pendulum and physical pendulum