## PHY 2048  Physics with Calculus 1

**Course Description:** Foundation course for physical science and engineering majors. PHY 2048 covers classical mechanics and thermodynamics. PHY 2049 includes electricity, magnetism, waves and optics.

<table>
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<th>Course Competency</th>
<th>Learning Outcomes</th>
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| **Competency 1:** The student will demonstrate an understanding of the scientific method by: | 2. Numbers / Data  
3. Critical thinking  
4. Information Literacy |
| 1. Explaining how the scientific method differs from 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 a 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 which 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 for a 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.

**Course 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.
4. Applying Bernoulli’s equation to fluid flow.

**Course 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.