PHYS 0110 Learning Objectives

Module 1. You should be able to: explain the difference between units and dimensions; write a value in scientific format with a sensible number of significant figures; use dimensional analysis to detect a dimensional inconsistency; apply basic geometry results; use trigonometric functions; explain the difference between a scalar and a vector; calculate the magnitude of a vector in two dimensions; add, subtract and decompose vectors in two dimensions.

Module 2. You should be able to: calculate the speed of an object moving in one dimension; calculate the displacement of an object moving with constant velocity in a fixed direction; calculate the displacement of an object moving with constant acceleration in a fixed direction; mathematically describe the free fall of an object, neglecting air resistance; derive the time of descent of an object.

Module 3. You should be able to: write the kinematics equations in more than one dimension; calculate the displacement of an object; find the coordinates and velocity components of a projectile; qualitatively apply the concept of inertia; apply the relation between force and acceleration in one and two dimensions; apply the action-reaction principle.

Module 4. You should be able to: distinguish contact forces from fundamental forces; apply the law of universal gravitation to two objects; draw a free body diagram for an object acted upon by no more than four forces; find tension, normal forces, gravitational force on an either stationary or moving object; consistently identify the boundaries of a mechanical system; solve Newton's second law problems for a mechanical system.

Module 5. You should be able to: distinguish between static and kinetic friction; find the coefficient of friction with and without motion; explain the occurrence of terminal velocity in a fluid; find angular position, angular displacement, and angular velocity; find speed and forces on an object performing uniform circular motion; apply Newton's second law for an objects performing uniform circular motion.

Module 6. You should be able to: apply the concept of work of a force; calculate the work of a constant force; apply the work-energy theorem; apply the principle of conservation of energy; find the work done by non-conservative forces in a mechanical system; calculate the power of a force.

Module 7. You should be able to: calculate the impulse of a constant force; apply the impulse-momentum theorem; distinguish between individual and total linear momentum; apply the principle of conservation of total linear momentum; calculate either initial or final velocities in completely elastic and completely inelastic collisions.

Module 8. You should be able to: describe a rigid rotation using angular displacement, angular velocity, angular acceleration; relate linear variables with angular variables; calculate the torque of a force; apply the right-hand rule for direction of a cross product; apply Newton's second law for rigid rotation; use the concept of moment of inertia; determine conditions for

static equilibrium of a rigid body; apply the relation between work of torque and rotation energy; apply the principle of conservation of total angular momentum.

Module 9. You should be able to: describe simple harmonic motion of a mass attached to an ideal spring; calculate the work done by an elastic force; apply generalized Hooke's law for longitudinal stress and shear stress; describe simple harmonic oscillations of a pendulum; distinguish between simple and physical pendulum; calculate period of a physical pendulum.

Module 10. You should be able to: qualitatively use the concept of pressure; apply Pascal's principle; calculate a buoyant force; apply the equation of continuity; apply Bernoulli's principle for ideal fluids; understand the origin of viscosity; calculate the pressure drop due to viscous flow.

Module 11. You should be able to: distinguish between concepts of temperature and heat; use the idea of thermal equilibrium; calculate the energy needed to change the temperature of an object; calculate the energy needed to change the phase of an object; calculate the geometric expansion of a material when heat is added or removed.

Module 12. You should be able to: distinguish a transverse wave from a longitudinal wave; mathematically describe a traveling wave, both transverse and longitudinal; find the distance traveled by a wave in given conditions; find the wavelength and frequency of a wave; find the speed of a wave on a taut string; find the speed of sound at different temperatures; calculate the power of a sound source and the intensity of a sound wave.

Module 13. You should be able to: calculate the frequency shift of sound due to relative motion between source and observer; apply the principle of linear superposition to traveling waves; apply geometrical conditions for constructive or destructive interference between two waves; find the wavelength or frequency of various modes of vibration in transverse and longitudinal standing waves.