GACE® Physics Assessment Test I (030)
Curriculum Crosswalk

	Required Coursework Numbers														
Subarea I. Mechanics (60%)															
Objective 1: Understands kinematics, vector and scalar quantities, and reference frames, including applications															
A. Understands vector and scalar quantities in describing motion and forces															
• Scalars such as mass, speed, time, and energy															
• Vectors such as displacement, velocity, acceleration, force, and momentum															
• Vector components															
• Vector addition (resultant vector)															
B. Understands motion in terms of displacement, velocity, and acceleration															
• Linear motion, including graphical interpretation															
• Simple harmonic motion, including pendulums and springs															
• Circular motion															
• Projectile motion															
• Rotational kinematics, such as angular displacement, angular velocity, and angular acceleration															
C. Understands frames of reference and their applications															
• Coordinate systems															

	Required Coursework Numbers														
• Distinguishes between inputs and outputs, and makes decisions based on costs and availability															
• Relative velocity															
Objective 2: Understands Newton's laws of motion, force, and universal gravitation, including applications															
A. Understands Newton's three laws of motion															
• Newton's first law of motion (mass, inertia, inertial reference frame)															
• Newton's second law of motion (net force, equilibrium)															
• Newton's third law of motion (action-reaction forces)															
• Applications such as inclined planes, simple pendulums, and Atwood's machine															
B. Understands friction, including forces and coefficients															
• Normal force															
• Frictional force															
• Air resistance															
• Coefficients of static and kinetic friction															
C. Understands circular motion															
• Centripetal acceleration															
• Centripetal force															

	Required Coursework Numbers														
D. Understands simple harmonic motion															
• Restoring force and Hooke's law															
• Properties of simple harmonic motion, such as frequency, period, amplitude, and damping															
• Pendulums															
• Spring oscillation															
E. Understands Newton's law of universal gravitation															
• Gravitational force and Newton's law of universal gravitation															
• Satellites and orbital motion															
• Acceleration due to gravity															
F. Understands the difference between weight and mass															
• Weight															
• Mass															
• Misconceptions about weight and mass															
• Relationship between density and mass															
G. Understands Kepler's three laws of planetary motion															
• Kepler's first law (law of ellipses)															
• Kepler's second law (law of equal areas)															
• Kepler's third law (relationship between orbital period and mean orbital radius)															

	Required Coursework Numbers														
H. Understands basic fluid mechanics															
• Properties of fluids, such as buoyancy, density, and pressure															
• Pascal's principle															
• Archimedes' principle															
• Bernoulli's principle															
Objective 3: Understands energy, linear momentum, angular momentum, and conservation laws, including applications															
A. Understands energy, work, and power and how they are related to one another															
• Mechanical energy (kinetic energy, potential energies, conservation of energy)															
• Energy transformations															
• Energy, work, and power															
• Simple machines, including the lever, pulley, and inclined plane															
• Mechanical advantage															
B. Understands linear momentum and impulse and how they are related to one another															
• Linear momentum															
• Impulse															
• Impulse and change in momentum															
C. Understands conservation laws															
• Conservation of energy															
• Conservation of linear momentum															
• Conservation of angular momentum															

	Required Coursework Numbers														
D. Understands the difference between elastic and inelastic collisions															
• Elastic collisions															
• Inelastic collisions															
• Conservation of kinetic energy															
• Conservation of linear momentum															
• Collisions in one and two dimensions															
E. Understands rotational motion															
• Center of mass															
• Angular momentum															
• Rotational inertia (moment of inertia)															
Subarea II. Thermodynamics, Atomic and Modern Physics (40%)															
Objective 1: Understands the laws of thermodynamics, heat, energy, and kinetic molecular theory, including applications															
A. Understands temperature, temperature scales, heat, and heat capacity															
• Temperature (average kinetic energy)															
• Temperature scales															
• Heat as thermal energy															
• Difference between temperature and heat															
• Heat capacity and specific heat															
• Calorimetry															
• Thermal expansion															

	Required Coursework Numbers														
B. Understands the mechanisms of heat transfer															
• Conduction															
• Convection															
• Radiation															
C. Understands different forms of energy and the transformations between them															
• Forms of energy, such as kinetic, potential, mechanical, electrical, electromagnetic, thermal, chemical, and nuclear															
• Energy transformations															
• Conservation of energy															
D. Understands energy involved in phase transitions between the various states of matter															
• Phase transitions															
• Phase diagrams															
• Heating and cooling diagrams															
• Heats of vaporization, fusion, and sublimation															
E. Understands kinetic molecular theory and the ideal gas laws															
• Kinetic molecular theory (assumptions of the theory, temperature, pressure, average molecular speeds)															
• Ideal gases and the ideal gas law															

	Required Coursework Numbers														
F. Understands the laws of thermodynamics															
• First law (internal energy, conservation of energy, work, heat)															
• Second law (entropy)															
• Third law (absolute zero)															
• Zeroth law (thermal equilibrium)															
• P-V diagrams															
• Thermodynamic processes, including isothermal, adiabatic, spontaneous, reversible, and irreversible															
• Carnot cycle, heat engines, and efficiency															
Objective 2: Understands atomic models and spectra, radioactivity, and topics in modern physics, including applications															
A. Understands the organization, structure, and states of matter															
• Atoms, molecules, ions															
• Solids, liquids, gases, plasmas															
• Chemical and physical properties and changes															
B. Understands the nature of atomic and subatomic structure, including various models of the atom															
• Atomic and subatomic structure (electrons, protons, neutrons, and isotopes)															
• Models of the atom, such as the Bohr model															

	Required Coursework Numbers														
• Experimental basis of atomic models (Rutherford's gold-foil experiment, Millikan's oil-drop experiment, Thomson's experiment)															
C. Understands the relationship of atomic spectra to electron energy levels															
• Bohr model of the atom															
• Discrete electron energy levels															
• Electron energy transitions in atoms															
• Absorption and emission spectra															
D. Understands the characteristics, processes, and effects of radioactivity															
• Radioactivity and radioactive decay processes															
• Alpha particles, beta particles, and gamma radiation															
• Half-life															
• Radioisotopes															
• Nuclear forces (strong and weak) and binding energy															
• Fission and fusion															
• Nuclear reactions															
E. Understands topics in modern physics															
• Wave-particle duality															
• Photoelectric effect															
• Blackbody radiation															

	Required Coursework Numbers														
• Special relativity															
• Mass-energy equivalence															
• Heisenberg uncertainty principle															
• de Broglie's hypothesis															