GACE® Physics Assessment Test II (031)
Curriculum Crosswalk

	Required Coursework Numbers														
Subarea I. Electricity and Magnetism (40%)															
Objective 1: Understands electrostatics, Coulomb's force law, and electric field and potential, including applications															
A. Understands Coulomb's law															
• Electric charge															
• Electrostatic force and Coulomb's law															
• Charging by conduction versus charging by induction															
B. Understands electric field and electric potential															
• Electric field															
• Electric potential															
• Voltage and potential difference															
• Electrical potential energy															
• Electric flux															
C. Understands basic applications of Gauss's law															
• Electric field inside a conductor (Faraday cage)															
• Electric field of an infinite plane															
D. Understands the conductive and resistive properties of materials															
• Conductors															
• Insulators															

	Required Coursework Numbers														
• Semiconductors															
• Superconductors															
Objective 2: Understands current, resistance, electrical circuits, and sources of potential, including applications															
A. Understands electric current, resistance, potential difference, energy, power, and the relationships between them															
• Electric current															
• Potential difference and voltage															
• Resistance and resistivity															
• Ohm's law															
• Energy and power															
• Direct current (DC) and alternating current (AC)															
B. Understands capacitance and inductance															
• Capacitance and capacitors															
• Inductance and inductors															
C. Understands how to analyze simple series, parallel, and combination circuits															
• Series, parallel, and combination circuits															
• Ohm's law and equivalent resistance															
• Kirchhoff's laws															
• Proper use of ammeters and voltmeters															
• Equivalent capacitance															

	Required Coursework Numbers														
D. Understands simple electrical devices and sources of electric potential															
• Batteries															
• Photocells															
• Generators															
Objective 3: Understands magnetic fields and forces, and changing electric and magnetic fields, including applications															
A. Understands magnetic fields															
• Magnetic field and magnetic flux															
• Magnets and magnetic poles, such as bar magnets, permanent magnets, electromagnets															
• Magnetic field generated by a steady current (Biot-Savart law)															
B. Understands magnetic forces															
• Force between current-carrying wires															
• Lorentz force law (force on point charge)															
• Direction of fields and forces (right-hand rule)															
C. Understands how a changing electric field produces a magnetic field and how a changing magnetic field produces an electric field															
• Ampere's law															
• Lenz's law (direction of induced current)															
• Faraday's law of induction															
• Motional emf															

	Required Coursework Numbers														
Subarea II. Optics and Waves (32%)															
Objective 1: Understands types of waves, wave properties and phenomena, and the Doppler effect, including applications															
A. Understands types of waves and their characteristics															
• Transverse and longitudinal waves															
• Amplitude, wavelength, frequency, period, speed, energy															
• Superposition and phase															
• Intensity and inverse square law															
• Standing waves															
B. Understands basic wave phenomena															
• Reflection, refraction, Snell's law, dispersion, total internal reflection															
• Diffraction, interference, superposition, Young's double-slit interference experiment															
• Polarization															
• Scattering, absorption, transmission															
• Resonance and natural frequencies, harmonics, beats															
C. Understands the fundamentals of the Doppler effect															
• Doppler effect and apparent frequency															
• Moving source															
• Moving observer															
• Redshift (blueshift) of light															

	Required Coursework Numbers														
Objective 2: Understands light, the electromagnetic spectrum, geometric optics, and sound, including applications															
A. Understands electromagnetic waves and the electromagnetic spectrum															
• Characteristics of electromagnetic waves															
• Visible light and color															
• Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X rays, and gamma rays)															
B. Understands geometric optics															
• Ray tracing															
• Focal point, image distance, image size and magnification, real versus virtual image, image orientation															
• Simple lenses (converging, diverging)															
• Mirrors (plane, convex, concave, spherical, parabolic)															
• Thin lens and mirror equations															
• Simple instruments such as the magnifying glass, telescope, and microscope															
• Prisms															
C. Understands the characteristics of sound															
• Compressional waves															
• Speed of sound (sonic boom, sound barrier)															
• Pitch (frequency), loudness (intensity)															

	Required Coursework Numbers														
• Beats															
• Air columns (open and closed pipes), standing waves, and harmonics															
Subarea III. Scientific Inquiry, Processes, Technology, and Society (28%)															
Objective 1: Understands scientific inquiry and technology, and the relationship to society and the environment															
A. Understands the processes involved in scientific inquiry															
• Identifying and formulating problems															
• Forming and testing hypotheses															
• Development of theories, models, postulates, assumptions, and laws															
• Process skills including observing, comparing, inferring, categorizing, generalizing, and concluding															
B. Understands experimental design															
• Testing hypotheses															
• Significance of controls, independent and dependent variables															
• Use and identification of variables															
• Data collection planning															
C. Understands the nature of scientific knowledge															
• Subject to change															
• Consistent with experimental evidence															
• Reproducibility															

	Required Coursework Numbers														
• Peer review															
• Unifying concepts and processes, including systems, models, constancy and change, equilibrium, and form and function															
D. Understands the major historical developments in physics and the contributions of major historical figures															
• How current principles, laws, models, and theories in physics developed over time															
• Major developments in physics, such as the atomic model and Newtonian mechanics															
• Major historical figures in the development of physics															
E. Understands the impact of physics and technology on society and the environment															
• Space exploration, communications															
• Climate change, greenhouse gases, ozone layer depletion, acid rain, water pollution, noise pollution															
• Production, storage, and disposal issues associated with consumer products															
• Recycling															
F. Understands applications of physics in daily life															
• Communications, such as wireless devices, fiber optics, and satellites															
• Research tools, such as space telescopes, lasers, and particle colliders															

	Required Coursework Numbers														
• Medicine, such as medical imaging and lasers															
• Transportation, including superconductors and magnetic levitation															
• Other applications															
G. Understands the advantages and disadvantages associated with various types of energy use															
• Renewable and nonrenewable energy resources															
• Conservation, recycling, and sustainability															
• Pros and cons of power generation based on various sources, such as fossil and nuclear fuel, hydropower, wind power, solar power, and geothermal power															
• Storage and distribution of renewable energy, including alternative fuels, fuel cells, and rechargeable batteries															
Objective 2: Understands how to conduct laboratory processes, including the collection and analysis of data															
A. Understands how to collect, evaluate, manipulate, interpret, and report data															
• Measurement uncertainty and significant figures in collected data and calculations															
• Organization and presentation of data															
• Interpreting and drawing valid conclusions from data presented in tables, graphs, and charts															
• Noting trends in data and relationships between variables															

	Required Coursework Numbers														
• Making predictions and drawing conclusions based on data															
B. Understands units of measurement, notation systems, conversions, and mathematics used in physics															
• Standard units of measurement															
• Unit conversion and dimensional analysis															
• Scientific notation															
• Measurement equipment															
C. Understands basic error analysis															
• Determining mean															
• Accuracy and precision															
• Identifying sources and effects of error and/or uncertainty															
• Percent error															
D. Understands the appropriate preparation, use, storage, and disposal of materials in the laboratory															
• Appropriate use															
• Safe disposal															
• Appropriate storage															
• Preparation for classroom use															
• Safe procedures and safety precautions															
E. Understands the appropriate use, maintenance, and calibration of laboratory equipment															
• Appropriate use															
• Appropriate storage															

	Required Coursework Numbers														
• Maintenance															
• Calibration															
• Preparation for classroom use															
• Safety procedures and precautions when using equipment															
F. Understands safety procedures and precautions for the high school physics laboratory															
• Location and use of standard safety equipment, such as eyewash stations and showers															
• Laboratory safety rules for students															
• Appropriate apparel and conduct in the laboratory, such as wearing goggles															
• Emergency procedures															