Subareas/Courses	PHYS1113	PHYS1114	PHYS2211	PHYS2212	PHYS3536	PHYS3537	PHYS3131	PHYS5130	PHYS5151	PHYS515	PHYS3420
MECHANICS											
Understand motion in one and two dimensions.											
• calculating displacement, average velocity, instantaneous velocity, and acceleration in a	X		X		X				X		
given frame of reference											
• solving problems involving displacement, time, velocity, and constant acceleration	X		X		X				X		
• interpreting algebraically and graphically relationships among position, velocity,	X		X		X				X		
acceleration, and time											
• analyzing problems involving motion in two dimensions (e.g., uniform circular motion,	X		X		X				X		
projectile motion)											
• analyzing properties of vectors (e.g., magnitude, direction, components) and solving	X		X		X				X		
problems involving vector quantities analytically and graphically											
Understand Newton's laws of motion and the universal law of gravitation.											
• analyzing examples of Newton's laws of motion in daily life	X		X		X				X		
• applying knowledge of free-body diagrams and vector properties to solve problems	X		X		X				X		
involving multiple forces in one and two dimensions											
• analyzing and solving problems involving frictional forces and coefficients (e.g., static,	X		X		X				X		
kinetic)											
• solving problems involving gravitational forces	X		X		X				X		
• applying knowledge of Newton's laws of motion to solve problems in one and two	X		X		X				X		
dimensions											
• solving problems involving torque and static equilibrium	X		X		X				X		
Understand the conservation of energy.											
• calculating the kinetic and potential energy of mechanical systems (e.g., object in free	X		X		X						
fall, mass on a spring, orbiting satellite or planet)											
• applying knowledge of the law of conservation of energy and the work-energy theorem to	X		X		X						
solve problems involving conservative and nonconservative forces											
• analyzing mechanical systems in terms of work, power, and energy	X		X		X						
Understand momentum and its conservation.											
• applying knowledge of the concept of impulse and the conservation of momentum to	X		X		X						
solve problems in one and two dimensions											
• applying knowledge of the concepts of energy and momentum to analyze elastic and	X		X		X						
inelastic collisions											
• applying knowledge of vectors to solve momentum problems	X		X		X						
• analyzing examples of conservation of angular momentum in everyday life	X		X		X						
WAVES AND THERMAL ENERGY											
Understand characteristics of mechanical waves.											
• analyzing models of harmonic motion (e.g., mass on a spring, pendulum)	X		X		X			X	X		
• analyzing the production and propagation of sound waves	X		X		X			X	X		
• analyzing reflection and transmission of mechanical waves	X		X		X			X	X		
• applying knowledge of the superposition principle to solve problems involving	X	X	X	X	X			X	X		
constructive and destructive interference											
• analyzing waves and solving problems involving amplitude, wavelength, period,	X	X	X	X	X	X		X	X		
frequency, and propagation speed in various media											
Understand the fundamental principles of light and optics.									X		
• analyzing properties of images produced by various mirrors		X		X	X		X				
• applying knowledge of ray diagrams and Snell's law to solve problems involving		X		X	X		X				
refraction											
• analyzing properties of images produced by convex and concave lenses		X		X	X		X				
• analyzing the phenomena of dispersion, diffraction, and polarization		X		X	X		X				
• analyzing wave properties of the electromagnetic spectrum		X		X	X		X				
Understand the principles of thermodynamics.									X		
• differentiating between thermal energy and temperature and solving problems involving		X		X	X						
thermal energy (e.g., thermal expansion, specific heat, internal energy)											
• identifying methods of thermal energy transfer (i.e., conduction, convection, and		X		X	X						
radiation)											
• applying knowledge of thermodynamic work and the law of conservation of energy to		X		X	X						
solve a variety of problems											

• demonstrating knowledge of the second law of thermodynamics		X		X	X						
• analyzing the states of matter and energy transformations during phase changes		X		X	X						
ELECTRICITY, MAGNETISM, AND ATOMIC PHYSICS											
Understand electric charge and interactions between charged objects.											
• demonstrating knowledge of principles and applications of electrostatics		X		X	X					X	
(e.g., conservation of charge, charging by induction)											
• solving problems using Coulomb's law		X		X	X					X	
• demonstrating knowledge of the electric field in the vicinity of point charges		X		X	X					X	
• solving basic problems involving electrostatic potential and electrostatic potential energy		X		X	X					X	
Understand magnets, magnetic fields, and electromagnetic induction.											
• demonstrating knowledge of the properties of permanent magnets		X		X	X					X	X
• determining the strength and orientation of the magnetic field near a current-carrying wire		X		X	X					X	X
• solving problems involving charged particles moving through a magnetic field		X		X	X					X	X
• demonstrating knowledge of direction and relative magnitude of an induced EMF in a		X		X	X					X	X
conductor											
• analyzing applications of electromagnetism (e.g., transformers, inductors, motors,		X		X	X					X	X
generators)											
• demonstrating knowledge of the generation of electromagnetic waves and their		X		X	X	X				X	X
applications (e.g., radio transmitters)											
Understand properties of electric circuits.											
• interpreting simple schematic diagrams of DC circuits		X		X						X	X
• analyzing series and parallel circuits using Ohm's law		X		X						X	X
• demonstrating knowledge of energy conservation in simple circuits		X		X						X	X
• differentiating between alternating and direct current circuits		X		X						X	X
Understand the basic processes of atomic and nuclear physics.											
• analyzing differences between fission and fusion and the applications of each		X		X		X				X	
• demonstrating knowledge of models of nuclear and subatomic structures and behaviors		X		X		X				X	
(e.g., spontaneous nuclear reactions)											
• demonstrating knowledge of the half-life of radioactive isotopes		X		X		X				X	
• demonstrating knowledge of how the basic principles of quantum mechanics can be		X		X		X				X	
used to describe the properties of light and matter (e.g., Bohr model, energy of a photon)											
CHARACTERISTICS OF SCIENCE											
Understand the characteristics of scientific knowledge and the process of scientific											
inquiry.											
• demonstrating knowledge of the nature, purposes, and characteristics of science	X	X	X	X	X	X	X	X	X	X	X
(e.g., reliance on verifiable evidence) and the limitations of science in terms of the kinds											
of questions that can be answered											
• recognizing the dynamic nature of scientific knowledge through the continual testing,	X	X	X	X	X	X	X	X	X	X	X
revision, and occasional rejection of existing theories											
• determining an appropriate scientific hypothesis or investigative design for addressing a	X	X	X	X	X	X	X	X	X	X	X
given problem											
• demonstrating knowledge of the principles and procedures for designing and carrying out	X	X	X	X	X	X	X	X	X	X	X
scientific investigations (e.g., changing one variable at a time)											
• recognizing the importance of and strategies for avoiding bias in scientific investigations	X	X	X	X	X	X	X	X	X	X	X
Understand the collection, analysis, and communication of scientific data.											
• identifying appropriate tools and units for measuring objects or substances	X	X	X	X	X	X	X	X	X	X	X
• recognizing potential safety hazards and procedures for the safe and proper use of	X	X	X	X	X	X	X	X	X	X	X
scientific tools, instruments, chemicals, and other materials in investigations											
• recognizing the concepts of precision, accuracy, and error and identifying potential	X	X	X	X	X	X	X	X	X	X	X
sources of error in gathering and recording data											
• identifying methods (e.g., appropriate mathematical concepts, tables, graphs) and criteria	X	X	X	X	X	X	X	X	X	X	X
for organizing and analyzing data											
• identifying appropriate methods for communicating the outcomes of scientific	X	X	X	X	X	X	X	X	X	X	X
investigations (e.g., publication in peer-reviewed journals)											
• demonstrating familiarity with effective resources and strategies for reading (e.g., graphic	X	X	X	X	X	X	X	X	X	X	X
organizers) to gain information about science-related topics and developing subject-area											