

M.Ed. in Secondary Education (Certification 6-12)
Natural and Social Science Requirements for Physics Majors

The following undergraduate courses in the natural and social sciences, or their equivalent(s), must be completed in addition to the major field and, if required, the secondary teaching field: **College Physics I and II and Labs** (PHYS 111, PHYS 112, PHYS 131, PHYS 132); **Modern Physics and Labs** (PHYS 235, PHYS 237, PHYS 238); **Mathematical Methods in Physics** (PHYS 301); **Electronics I – Lecture and Lab** (PHYS 303); **Optics – Lecture and Lab** (PHYS 310); **Theoretical Mechanics I** (PHYS 314); **Thermal Physics and Statistical Mechanics** (PHYS 328); **Electricity and Magnetism I** (PHYS 351); **Quantum Mechanics** (PHYS 361); **General Chemistry A and B and Labs** (CHEM 101, CHEM 102, CHEM 111, CHEM 112); **General Biology I and II and Labs** (BIOL 101, BIOL 102, BIOL 111, BIOL 112); **Philosophy of Science** (PHIL 173); **Science, Technology, and Society** (SOCL 126).

Physics Courses

PHYS 235: (Modern Physics): Special relativity, blackbody spectrum, photoelectric effect, Compton effect, Bohr atom, DeBroglie waves, Schrodinger equation and applications.

PHYS 237: (Modern Physics Laboratory): One two-hour laboratory period per week. Complements 235.

PHYS 238: (Intermediate Physics Laboratory): One two-hour laboratory period per week. Follows 237.

PHYS 301: (Mathematical Methods in Physics): Mathematical and computer methods in physics and engineering. Topics include vector calculus, functions of a complex variable, phasors, Fourier analysis, linear transformations, matrices, first and second order differential equations, special functions, numerical and symbolic computer applications.

PHYS 303: (Electronics I – Lecture and Laboratory): Direct and alternating current circuit analysis, resonant circuits, junction diode circuits, transistor amplifiers, operational amplifiers, oscillators and multivibrators.

PHYS 310: (Optics – Lecture and Laboratory): Electromagnetic nature of light, polarization, Fresnel relations, imaging, interference, Fraunhofer and Fresnel diffraction, selected topics from Fourier optics, lasers, and holography.

PHYS 314: (Theoretical Mechanics I): Newtonian particle dynamics, oscillations, variational principle. Lagrange's and Hamilton's formalisms.

PHYS 328: (Thermal Physics and Statistical Mechanics): Concepts of temperature and heat, equations of state, laws of thermodynamics and applications, fundamental principles and simple applications of statistical mechanics.

PHYS 351: (Electricity and Magnetism I): Applications of vector calculus to electric fields and potentials. Solutions of Laplace's Equation. Electrostatics, magnetostatics, electromagnetic field energy. Maxwell's equations.

PHYS 361: (Quantum Mechanics): Principles and mathematics of quantum mechanics, operators and representations, solutions to Schrodinger equation.

Chemistry Courses:

CHEM 101: (General Chemistry A): The course deals with the development of basic chemical principles. Topics include atomic and molecular structures, states of matter, energetics and stoichiometry of reactions.

CHEM 102: (General Chemistry B): A continuation of 101. Topics include equilibrium systems, periodic properties, descriptive chemistry.

CHEM 111: (General Chemistry Laboratory A): This laboratory course experimentally illustrates the topics covered in the lecture (101).

CHEM 112: (General Chemistry Laboratory B): This laboratory course experimentally illustrates the topics covered in the lecture (102).

Biology Courses:

BIOL 101: (General Biology I): Fundamental principles of Biology including: introduction to the scientific method, basic biological chemistry; cell structure and function; energy transformations; mechanisms of cell communication; cellular reproduction; and principles of genetics.

BIOL 102: (General Biology II): A continuation of Biology 101. Fundamental principles of Biology including: evolutionary theory; general principles of ecology; study of plant structure and function; and comparative animal physiology.

BIOL 111: (General Biology Laboratory I): Complements General Biology I lecture material through observation, experimentation, and when appropriate, dissection of representative organisms. Physical and chemical phenomena of life as well as systematics and comparative anatomy and physiology of selected organisms will be examined.

BIOL 112: (General Biology Laboratory II): Complements General Biology II lecture material through observation, experimentation, and when appropriate, dissection of representative organisms. Physical and chemical phenomena of life as well as systematics and comparative anatomy and physiology of selected organisms will be examined.

Other Courses:

PHIL 173: (Philosophy of Science): This course examines the nature of scientific knowledge and the principles used to acquire it. Episodes in the history of the natural and social sciences will illustrate scientific principles and practices. As part of this analysis, we will examine the philosophical foundations of inductive reasoning, explanation, observation, causation, and evidence. We will give special attention to scientific issues that have distinctive social and ethical impact, and will discuss general metaphilosophical issues, such as the role of philosophy in clarifying and commenting on science.

SOCL 126: (Science, Technology, and Society): This course serves as a broad introduction to the social study and analysis of science and technology in society. It examines how scientific knowledge and technologies are created and constructed and how they influence and are influenced by society.