PHYSICS (PHYS)

PHYS 100. PHYSICAL SCIENCE I. 5 Credits.
Pre-requisites: MTHD 104 or MTHD 106, with a grade ≥C, or math placement score.
Satisfies: a BACR for natural sciences.
This course covers the elementary aspects of physical science and astronomy, including topics such as force and motion, density, energy, and electricity. It operates in an informal laboratory mode with ample opportunity for discussion and individual assistance.

PHYS 110. ENERGY, SOCIETY AND THE ENVIRONMENT. 5 Credits.
Notes: lecture course with lab type activities integrated into the coursework.
Pre-requisites: MTHD 104 or MTHD 106, with a grade ≥C, or math placement score.
Satisfies: a BACR for natural science.
This course covers the basic scientific concepts about how society generates and uses energy. Various sources of energy will be covered along with their associated benefits and drawbacks for each source in terms of effect on the environment and how we live our lives. These concepts will be developed within the context of physics principles such as energy physics, efficiency of energy transmission, power and theoretical limitations.

PHYS 115. INVESTIGATING PHYSICAL SCIENCE. 5 Credits.
Notes: laboratory work related to the covered topics is included nearly every day.
Pre-requisites: MATH 208 or equivalent.
Satisfies: a BACR for natural sciences.
For students planning to teach elementary school. Includes inquiry based physical science investigations that support science instruction outlined in the National Science Education Standards and Washington Essential Academic Learning Requirements.

PHYS 120. HONORS EXPERIENCE: NATURAL SCIENCE. 5 Credits.
Cross-listed: HONS 120.
Satisfies: a BACR for natural science.
This course introduces students to the mission and goals of EWU's Honors Program while supporting advanced student success skills and critical thinking in academic content within the Natural Science breadth area.

PHYS 121. DESCRIPTIVE ASTRONOMY. 5 Credits.
Notes: Laboratory work related to the covered topics is included. May include planetarium sessions.
Pre-requisites: pre-university basic skills in mathematics.
Satisfies: a BACR for natural sciences.
This course develops astronomy from early geocentric models of the cosmos through the Copernican revolution to our modern understanding. The tools of astronomy are discussed, and how physical laws are applied in astronomy. Course topics draw from the subjects of our Sun, our solar system and planets, exoplanets, stars, galaxies, large-scale structure and cosmology.

PHYS 126. MAKING SENSE OF THE COSMOS. 5 Credits.
Cross-listed: HONS 126.
Pre-requisites: MTHD 104 or MTHD 106, with a grade ≥C, or equivalent math placement score.
Satisfies: a BACR for natural science.
Our modern scientific view of the cosmos is a material universe obeying the laws of physics. This class explores the origins this view, covering the history, philosophy, physics, and astronomy behind it. The development is traced from classical Greece through the medieval Islamic world and the European Scientific Revolution into our modern understanding. The nonlinear and messy nature of this process is stressed, and key scientific, philosophical, religious, and cultural influences are examined.

PHYS 131. INTRODUCTORY PHYSICS I. 4 Credits.
Notes: concurrent enrollment in PHYS 161 is recommended.
Pre-requisites: MATH 142.
Satisfies: the completion of PHYS 131 and PHYS 161 combined counts as one BACR for natural science.
Part of a three-quarter beginning sequence (PHYS 131, PHYS 132, PHYS 133) suitable for all students of natural science and mathematics. Topics covered include one and multi-dimensional kinematics and dynamics, energy, momentum, and rotational motion.

PHYS 132. INTRODUCTORY PHYSICS II. 4 Credits.
Notes: programs that require PHYS 132 often require the associated lab (PHYS 162), for which enrollment is separate.
Pre-requisites: PHYS 131.
Satisfies: the completion of PHYS 132 and PHYS 162 combined counts as one BACR for natural science.
This is a continuation of PHYS 131, and covers fluids, oscillations and waves, thermal physics, electrostatics, and simple circuitry.

PHYS 133. INTRODUCTORY PHYSICS III. 4 Credits.
Notes: programs that require PHYS 133 often required the associated lab, PHYS 163, for which enrollment is separate.
Pre-requisites: PHYS 132.
This is a continuation of PHYS 132. Content includes magnetism and Faraday's Law, geometrical and wave optics, special relativity and selected topics in quantum theory.

PHYS 151. GENERAL PHYSICS I. 4 Credits.
Notes: concurrent enrollment in PHYS 161 is recommended.
Pre-requisites: MATH 161, HONS 161 or concurrent enrollment.
Satisfies: the completion of PHYS 151 and PHYS 161 combined counts as one BACR for natural science.
Part of a four-quarter beginning sequence (PHYS 151, PHYS 152, PHYS 153, PHYS 221) suitable for all students of natural science and mathematics. Topics covered include one and multi-dimensional kinematics and dynamics, energy, momentum, and rotational motion.

PHYS 152. GENERAL PHYSICS II. 4 Credits.
Notes: concurrent enrollment in PHYS 162 is recommended.
Pre-requisites: PHYS 151 and concurrent enrollment in MATH 162.
Satisfies: the completion of PHYS 152 and PHYS 162 combined counts as one BACR for natural science.
Part of a four-quarter beginning sequence (PHYS 151, PHYS 152, PHYS 153, PHYS 221) suitable for all students of natural science and mathematics. Topics covered include: rotational motion, gravity, fluids, oscillations, waves, and thermodynamics.

PHYS 153. GENERAL PHYSICS III. 4 Credits.
Notes: concurrent enrollment in MATH 163 and PHYS 163 recommended.

Pre-requisites: PHYS 152, MATH 162.
Part of a four-quarter beginning sequence (PHYS 151, PHYS 152, PHYS 153, PHYS 221) suitable for all students of natural science and mathematics. Topics covered include: electrostatics, direct current circuit theory, magnetism, and induction.

PHYS 161. MECHANICS LABORATORY. 1 Credit.
Pre-requisites: MATH 142.
Satisfies: the completion of PHYS 161, combined with either PHYS 131 or PHYS 151, counts as one BACR for natural science.
A laboratory course in mechanics, including kinematics, forces, dynamics, conservation of energy and momentum, data and error analysis, and experimental design.

PHYS 162. HEAT AND OPTICS LABORATORY. 1 Credit.
Pre-requisites: MATH 142.
Satisfies: the completion of PHYS 162, combined with either PHYS 132 or PHYS 152, counts as one BACR for natural science.
A laboratory course in heat and optics. Experiments in optics include reflection and refraction, lenses and mirrors, microscopes and telescopes, and optical spectra. Experiments in heat include heat and temperature, thermal expansion, mechanical and electrical equivalents of heat and a study of gas laws.

PHYS 163. ELECTRONICS LABORATORY I. 1 Credit.
Pre-requisites: MATH 142.
This lab course covers electrostatics and concepts of simple DC circuitry, Kirchhoff's loop rule and junction rule, and the includes the operational principles of ammeters and voltmeters.

PHYS 196. EXPERIMENTAL COURSE. 1-5 Credits.

PHYS 221. GENERAL PHYSICS IV. 4 Credits.
Pre-requisites: PHYS 153.
Topics covered include: electromagnetism, alternating current circuit theory, Maxwell's equations, physical optics, quantization, and relativity.

PHYS 263. ELECTRONICS LABORATORY II. 1 Credit.
Pre-requisites: PHYS 163.
This course covers principles of AC circuits with reactive elements; the operation of transformers; diode operation and theory; and simple semiconductors.

PHYS 296. EXPERIMENTAL COURSE. 1-5 Credits.

PHYS 299. SPECIAL STUDIES. 1-5 Credits.

PHYS 311. ESTIMATION IN PHYSICS. 1 Credit.
Notes: graded Pass/Fail.
Pre-requisites: PHYS 221.
This course covers the crucial skill of taking real-world problems, analyzing their key elements, and deploying estimation and approximation techniques to make the problems tractable on the back of an envelope. It covers dimensional analysis, order-of-magnitude estimation, explicit mathematical approximations like truncating series, and application of approximate physical theories.

PHYS 321. ADVANCED PHYSICS LABORATORY I. 3 Credits.
Pre-requisites: junior standing or permission of the instructor.
A laboratory course dealing with classical experiments in all of physics as well as introducing many modern measurement techniques in atomic and nuclear physics.

PHYS 322. ADVANCED PHYSICS LABORATORY II. 3 Credits.
Pre-requisites: junior standing or permission of the instructor.
A laboratory course dealing with classical experiments in all of physics as well as introducing many modern measurement techniques in atomic and nuclear physics.

PHYS 361. CLASSICAL MECHANICS I. 4 Credits.
Pre-requisites: PHYS 153, MATH 163.
A study of statics and dynamics from a mathematical point of view; an introduction to Lagrange's Equations.

PHYS 362. CLASSICAL MECHANICS II. 4 Credits.
Pre-requisites: PHYS 361.
A study of statics and dynamics from a mathematical point of view; an introduction to Lagrange's Equations.

PHYS 363. RELATIVITY. 4 Credits.
Pre-requisites: PHYS 153, MATH 162.
An introduction to special relativity, and its implications for particle dynamics and electromagnetic fields at high speeds. Applications to particle physics and astrophysics are discussed. Some basic aspects of general relativity are also introduced, including the metric and its application to black holes.

PHYS 371. QUANTUM PHYSICS I: INTRODUCTION. 4 Credits.
Pre-requisites: MATH 163, PHYS 221.
An introduction to the origin and development of quantum theory with emphasis on the classical experiments leading to Schroedinger's wave mechanics and applications of Schroedinger's Equation to simple systems. Explicit solutions of the standard one dimensional problems and the use of the linear algebraic Dirac formalism will be discussed in detail.

PHYS 372. QUANTUM PHYSICS II: ATOMIC. 4 Credits.
Pre-requisites: MATH 241 and PHYS 371.
A study of the application of quantum theory to the description of atoms, including exactly solvable problems and key approximation methods. Atomic structure and the resulting spectra are discussed.

PHYS 395. CO-OP FIELDWORK. 1-5 Credits.

PHYS 396. EXPERIMENTAL COURSE. 1-6 Credits.

PHYS 401. ELECTROMAGNETISM I. 4 Credits.
Pre-requisites: MATH 241 and PHYS 221.
This course consists of topics in electrostatics: the electric field, Gauss' Law, the scalar potential, electromagnetic energy and polarizable media. Extensive use is made of vector calculus.

PHYS 402. ELECTROMAGNETISM II. 4 Credits.
Pre-requisites: PHYS 401.
This course consists of topics including: magnetostatics and some time-varying fields, the Biot-Savart Law, Ampere's Law, the vector potential, Faraday's Law, and magnetostatics in the presence of magnetizable matter.

PHYS 411. CLASSICAL THERMODYNAMICS. 4 Credits.
Pre-requisites: PHYS 153, MATH 163.
Introduction to elementary thermodynamics; first, second and third laws of thermodynamics; ideal gases; and kinetic theory, elementary Boltzmann statistics.

PHYS 415. QUANTUM FUNDAMENTALS FOR COMPUTING AND CRYPTOGRAPHY. 4 Credits.
Notes: prior completion of PHYS 221 recommended.
Pre-requisites: PHYS 152, MATH 161, MATH 231, or instructor permission.
An introduction to quantum mechanics for those interested in its applications to quantum cryptography and quantum computing. Foundational topics covered include state vectors, measurement, operators, probability, spin, superposition, entanglement, and decoherence. Applications to qubits, quantum gates, quantum key distribution, and quantum parallelism are introduced.

PHYS 421. COMPUTATIONAL PHYSICS. 4 Credits.
Pre-requisites: MATH 163, PHYS 153.
Introduction to programming to solve physics problems in data analysis, theory, and statistics that are not amenable to analytical solution. Covers computational basics, model fitting, computational statistical techniques, introductory data science, numerical differential equation solutions, iteration, convergence, and basic simulations.

PHYS 424. ASTROPHYSICS. 4 Credits.
Pre-requisites: MATH 163, PHYS 153.
Application of the physical principles of mechanics, fluid dynamics, thermodynamics, electromagnetism, optics and relativity within the astronomical contexts of observational techniques/instrumentation, planetary science, stellar structure/evolution, galactic/extragalactic structure and cosmology.

PHYS 431. SOLID STATE DEVICES PHYSICS. 3 Credits.
Pre-requisites: MATH 163, PHYS 221.
A course dealing with crystalline semiconductors, carrier transport generation and recombination, p-n junctions, metal-semiconductor junctions, microwave devices, photonic devices like solar cells and semiconductor lasers.

PHYS 451. OPTICS. 4 Credits.
Pre-requisites: MATH 163, PHYS 153.
A study of the nature of light and its applications, with emphasis on physical optics and the electromagnetic wave theory of light. Topics selected from modern optics include Fourier optics, basics of coherence theory, and aspects of the quantum nature of light.

PHYS 491. SENIOR THESIS. 4 Credits.
Pre-requisites: senior standing and permission of instructor.
Satisfies: a university graduation requirement—senior capstone.
Directed research on a topic in physics leading to a written or oral report. See your advisor for further information.

PHYS 495. INTERNSHIP. 1-5 Credits.
Prerequisite: permission of the instructor, department chair and college dean

PHYS 496. EXPERIMENTAL COURSE. 1-5 Credits.

PHYS 497. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-6 Credits.

PHYS 498. SEMINAR. 1-2 Credits.

PHYS 499. DIRECTED STUDY. 1-5 Credits.
Prerequisite: permission of the instructor, department chair and college dean

PHYS 596. SPECIAL TOPICS. 1-5 Credits.

PHYS 597. WORKSHOP, SHORT COURSE, CONFERENCE, SEMINAR. 1-5 Credits.

PHYS 598. SEMINAR. 1-5 Credits.

PHYS 599. INDEPENDENT STUDY. 1-5 Credits.

PHYS 696. COLLEGE TEACHING INTERNSHIP. 1-5 Credits.