PHYSICS (PHYS)

Physicists are concerned with understanding the fundamental laws of Nature. The pursuit of that understanding leads to many practical applications. Physics is a rewarding area of study because it provides both a basis for understanding the natural world and modern technology, and satisfies one's intellectual curiosity. The fundamental character of physics makes it a discipline that is central to the liberal arts. The Physics curriculum at Western provides opportunities for students to take course work that supports other scientific and technical disciplines, to complete an academic major or minor, or to prepare for physics and engineering programs at other institutions.

The courses listed for each of the following emphases are the minimum requirements. Higher-level supporting courses may be appropriate for students pursuing certain careers. Students should consult with their advisors for proper course selections. All majors require a Capstone Course.

- Physics Minor (https://catalog.western.edu/undergraduate/programs/physics/physics-minor/)

Capstone Course Requirement

The following course in the Applied Physics/Pre-Engineering Major fulfill the capstone course requirement: PHYS 495.

Physics Courses

PHYS 110. Introductory Astronomy (GT-SC2). (3 Credits)
An overview of the historical development of astronomy and the basic physical principles that are relevant to it. The overall structure of the Universe is studied and its various components examined. Includes limited observational activities. Prerequisite: completion of the general education essential skills mathematics requirement. GT-SC2

PHYS 115. Physics of Music. (3 Credits)
A practical introduction to the physics of sound, with emphasis on music. Students investigate the properties of sounds produced by musical instruments. Topics include periodic functions, waves, resonance, overtones, frequency spectra, digital sound production and basic acoustic principles. Prerequisite: ACT math score of 19 or above; SAT math score of 500 or above; MATH 099 or university-level math requirement with a minimum grade of "C-"; or Accuplacer Advanced Algebra and Functions test score of 245 or above.

PHYS 120. Meteorology (GT-SC2). (3 Credits)
A summary of the structure of the Earth's atmosphere, worldwide weather disturbances, weather forecasting, and snow avalanches. This course may not be taken for credit toward the Physics Minor. GT-SC2

PHYS 125. Energy and the Environment (GT-SC2). (3 Credits)
A practical study of energy generation and its environmental impact, including the physics of energy fundamentals, fossil fuel use, alternative energy uses, and energy conservation. Primarily for non-science majors, this course will qualitatively detail basic physical principles behind the use of energy, including mechanics, electricity and magnetism, and thermodynamics. This course is designed to provide the student with a physicist's perspective on energy use and environmental issues. Prerequisite: completion of the general education essential skills mathematics requirement. GT-SC2

PHYS 140. Introductory Physics (with laboratory) (GT-SC1). (4 Credits)
A semi-quantitative introduction to the fundamental concepts of physical science, particularly the laws of physics as they relate to the structure of matter. Laboratory experiences play an important role in the investigations. This course may not be taken for credit toward the Physics Minor. Additional course fee applies. Prerequisite: ACT math score of 19 or above; SAT math score of 500 or above; MATH 099; Accuplacer Advanced Algebra and Functions test score of 245 or above. GT-SC1

PHYS 170. Principles of Physics I (with laboratory) (GT-SC1). (4 Credits)
A quantitative lecture and laboratory introduction to the basic principles of physics. Topics covered include the motions of particles, forces in nature, field concepts, energy, conservation laws, and many-particle systems. A mathematical proficiency at the level of university algebra is recommended. Additional course fee applies. Prerequisites: MATH 141. GT-SC1

PHYS 171. Principles of Physics II (with laboratory) (GT-SC1). (4 Credits)
A continuation of PHYS 170 dealing with electromagnetism, light, thermodynamics, and the atomic structure of matter. Additional course fee applies. Prerequisite: PHYS 170. GT-SC1

PHYS 197. Special Topics. (1-6 Credits)

PHYS 200. General Physics I (with laboratory) (GT-SC1). (4 Credits)
A quantitative lecture and laboratory introduction to the basic principles of physics, using the concepts of calculus as a tool. Topics covered include the motions of particles, forces in nature, field concepts, energy, conservation laws, many-particle systems, and thermodynamics. A student may not receive credit for both PHYS 170 and PHYS 200. Additional course fee applies. Prerequisite or Corequisite: MATH 151. GT-SC1

PHYS 201. General Physics II (with laboratory) (GT-SC1). (4 Credits)
A continuation of PHYS 200 dealing with electromagnetism, light, and the atomic structure of matter. A student cannot receive credit for both PHYS 171 and 201. Additional course fee applies. Prerequisite: PHYS 200 (require minimum grade of C- or higher). GT-SC1

PHYS 250. Statics. (3 Credits)
An investigation of systems in static equilibrium. Topics covered include force systems, 2dand 3d equilibrium, structural analysis, internal forces, friction, distributed forces and virtual work. Prerequisites: PHYS 171 or PHYS 201; MATH 251.

PHYS 251. Dynamics. (3 Credits)
An investigation of the kinematics and kinetics of particles and rigid bodies as well as modes of vibration and time response. Topics covered include coordinate systems, work-energy relations, momentum, relative motion and vibrations. Prerequisite: PHYS 250.

PHYS 297. Special Topics. (1-6 Credits)

PHYS 320. Modern Physics. (3 Credits)
An introduction to the special theory of relativity, quantum physics, atomic physics, and sub-atomic physics. Prerequisites: PHYS 171 or PHYS 201; prerequisite or co-requisite: MATH 251.

PHYS 330. Classical Mechanics. (3 Credits)
A treatment of classical mechanics, including kinematics and dynamics, particle dynamics, energy, and gravitation. Prerequisites: PHYS 171 or PHYS 201; MATH 251.
PHYS 335. Fluid Mechanics. (3 Credits)
Examines fundamentals of fluid flow with application to engineering problems. Topics covered include fluid statics and kinematics, Bernoulli equations, laminar and turbulent viscous boundary layers, laminar and turbulent pipe flow, and conservation equations for mass, momentum and energy. Prerequisites: MATH 251 and PHYS 250.

PHYS 350. Electricity and Magnetism I. (3 Credits)
A study of electrostatic fields and potentials, the electrical properties of matter, magnetic phenomena and the magnetic properties of matter. Prerequisites: PHYS 171 or PHYS 201; MATH 252.

PHYS 351. Electricity and Magnetism II. (3 Credits)
A continuation of PHYS 350 treating direct and alternating currents, electromagnetic induction, Maxwell’s equations, and electromagnetic radiation. Prerequisite: PHYS 350.

PHYS 397. Special Topics. (1-6 Credits)

PHYS 452. Quantum Mechanics. (3 Credits)
An introduction to the mathematical formalism of quantum mechanics and its application to various types of natural systems, such as multi-electron atoms, molecules, and solids. Prerequisites: PHYS 171 or PHYS 201; corequisite: MATH 252.

PHYS 462. Astrophysics. (3 Credits)
A study of selected topics in astrophysics as they relate to the core areas of physics: mechanics, electromagnetism, quantum physics, and thermodynamics. Topics covered may include stellar formation and life cycles, galactic dynamics and dark matter, planetary systems, multiple star systems, interstellar medium, cosmology, and the nature of light. Prerequisites: PHYS 171 or PHYS 201; MATH 252.

PHYS 495. Physics Capstone. (1 Credit)
A senior research and thesis course. The course is designed as the last opportunity to develop skills required before students enter the work force, graduate school or the next step in a chosen vocation. Students shall choose individualized research projects in consultation with an instructor that utilize experimental analysis, experimental investigation and/or computational simulation. Students will communicate their results through written work and a presentation. Prerequisites: PHYS 320.

PHYS 497. Special Topics. (1-6 Credits)