PHYSICS (PHYS)

PHYS 115 Descriptive Physics
Description: Qualitative approach to physics for the non-science major that emphasizes concepts and how they are used to understand the everyday physical world. Newton's description of motion and forces, the atomic view of matter, kinds and transformations of energy, the nature of electricity and magnetism, sound and light waves, and subatomic particles. Some topics selected according to student interest. Recommended for all students wanting a nonmathematical look at basic discoveries of physics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 4 Science

PHYS 141 Elementary General Physics I
Prerequisites: MATH 102 or equivalent.
Notes: Credit toward the degree may be earned in only one of: PHYS 141, 141H, and 151. Lab fee required.
Description: Mechanics, heat, waves and sound.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: MSYM 232; MSYM 262; MSYM 452, MSYM 852, WATS 452, AGRO 452
ACE: ACE 4 Science

PHYS 141H Honors: Elementary General Physics I
Prerequisites: Good standing in the University Honors program or by invitation; MATH 102 or equivalent.
Notes: Credit toward the degree may be earned in only one of: PHYS 141, 141H, and 151. Lab fee required.
Description: For course description, see PHYS 141.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: MSYM 232; MSYM 262; MSYM 452, MSYM 852, WATS 452, AGRO 452
ACE: ACE 4 Science

PHYS 151 Elements of Physics
Prerequisites: MATH 102 or equivalent high school preparation.
Notes: Credit toward the degree may be earned in only one of: PHYS 141, 141H, and 151.
Description: Short course, without laboratory, for those who need one semester of elementary general physics. Emphasis on understanding our physical environment through application of principles of mechanics, heat, sound, electricity, and light.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: CNST 306; MSYM 109L; MSYM 232; MSYM 262; MSYM 452, MSYM 852, WATS 452, AGRO 452
ACE: ACE 4 Science

PHYS 142 Elementary General Physics II
Prerequisites: PHYS 141 or 141H.
Description: Continuation of PHYS 141. Electricity, magnetism, optics, relativity, atomic and nuclear physics.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: GEOL 344
ACE: ACE 4 Science

PHYS 142H Honors: Elementary General Physics II
Prerequisites: Good standing in the University Honors program or by invitation; PHYS 141 or 141H.
Notes: Lab fee required.
Description: For course description, see PHYS 142.
Format: LEC
Prerequisite for: GEOL 344
ACE: ACE 4 Science

PHYS 153 Elements of Physics Laboratory
Prerequisites: PHYS 151 or parallel PHYS 151.
Description: Laboratory experiments in mechanics, heat, and wave motion.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB
Prerequisite for: CNST 306

PHYS 198 Special Topics in Physics
Description: Topic varies.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: LEC

PHYS 201 Modern Topics in Physics and Astronomy
Description: Seminar/workshop that introduces students to topics in modern physics research in basic and applied areas. Students given an understanding of how their studies relate to current progress in physics and astronomy and to prepare for careers in physics-related disciplines.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC
PHYS 211 General Physics I  
**Prerequisites:** One year high school physics or PHYS 141 or 141H or 151 or permission; MATH 106 or parallel

**Description:** Calculus-based course intended for students in engineering and the physical sciences. Mechanics, fluids, wave motion, and heat.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC

**Prerequisite for:** ASTR 204; BSEN 317; ECEN 223; MECH 250; METR 321; METR 323; MSYM 232; MSYM 262

**ACE:** ACE 4 Science

PHYS 211H Honors: General Physics I  
**Prerequisites:** Good standing in the University Honors Program or by invitation; MATH 106 or 106H or equivalent or parallel.

**Description:** For course description, see PHYS 211.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC

**Prerequisite for:** ASTR 204; BSEN 317; ECEN 223; MECH 250; METR 321; METR 323; MSYM 232; MSYM 262

**ACE:** ACE 4 Science

PHYS 212 General Physics II  
**Prerequisites:** One year high school physics or PHYS 211 or 211H or permission; MATH 107 or parallel.

**Description:** Continuation of PHYS 211. Electricity, magnetism, and optics.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC

**Prerequisite for:** AGEN 325, BSEN 325; ECEN 344; GEOL 360; MECH 541, MECH 821, ENGR 421

**ACE:** ACE 4 Science

PHYS 212H Honors: General Physics II  
**Prerequisites:** Good standing in the University Honors Program or by invitation; PHYS 211 or 211H; MATH 107 or equivalent or parallel.

**Notes:** A calculus-based course.

**Description:** For course description, see PHYS 212.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC

**Prerequisite for:** AGEN 325, BSEN 325; ECEN 344; GEOL 360; MECH 541, MECH 821, ENGR 421

**ACE:** ACE 4 Science

PHYS 213 General Physics III  
**Prerequisites:** PHYS 212; MATH 208 or parallel

**Description:** Continuation of PHYS 212. Relativity, quantum mechanics, atoms, and nuclei.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC

PHYS 213H Honors: General Physics III  
**Prerequisites:** Good standing in the University Honors Program or by invitation; PHYS 212 or 212H; MATH 208 or 208H, or parallel.

**Description:** Continuation of PHYS 212H. Relativity, quantum mechanics, atoms, and nuclei.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC

PHYS 221 General Physics Laboratory I  
**Prerequisites:** PHYS 211 or parallel.

**Description:** Experiments in mechanics, heat and wave motion.

**Credit Hours:** 1  
**Max credits per semester:** 1  
**Max credits per degree:** 1  
**Format:** LAB

PHYS 222 General Physics Laboratory II  
**Prerequisites:** PHYS 212 or parallel.

**Description:** Laboratory experiments in electromagnetism and optics.

**Credit Hours:** 1  
**Max credits per semester:** 1  
**Max credits per degree:** 1  
**Format:** LAB

PHYS 223 General Physics Laboratory III  
**Prerequisites:** PHYS 213 or parallel.

**Description:** Experiments in atomic and nuclear physics.

**Credit Hours:** 1  
**Max credits per semester:** 1  
**Max credits per degree:** 1  
**Format:** LAB

PHYS 231 Electrical and Electronic Circuits  
**Prerequisites:** PHYS 212 and 222.

**Description:** Diode, transistor, and operational amplifier circuits and analog applications; gates, flip-flops, and elementary digital electronics.

**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 260 Liberal Arts Physics: Matter and Motion  
**Prerequisites:** Two years high school algebra.

**Description:** Basic concepts of physics in a historical context and in relationship to the intellectual development of humankind. Mechanics, heat gravitation, and structure of the universe.

**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

**ACE:** ACE 4 Science

PHYS 261 Liberal Arts Physics: Atoms and Fields  
**Prerequisites:** Two years high school algebra.

**Description:** Basic concepts of physics in a historical context and in relationship to the intellectual development of humankind. Atomic structure of matter, states of matter, waves, and light. Practical consequences of the properties of matter and physical phenomena.

**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

**ACE:** ACE 4 Science
PHYS 262 Physical Sciences by Inquiry
Prerequisites: PHYS 260 or 261; or parallel.
Description: Selected physical science concepts using inquiry methods.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

PHYS 298 Special Topics in Physics
Prerequisites: Permission.
Credit Hours: 1-12
Min credits per semester: 1
Max credits per semester: 12
Max credits per degree: 12
Format: LEC

PHYS 311 Mechanics
Description: Review of vector operations and of the kinematics and dynamics of a particle. Dynamics of a system of particles, motion of rigid bodies, central force problems, collisions, Lagrangian techniques, oscillations, and coupled oscillators.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

PHYS 343 Physics of Lasers and Modern Optics
Prerequisites: PHYS 142 or 212; and a lab course in science or engineering.
Description: Physical principles and techniques of lasers and modern optics. Emphasis on practical experience with state-of-the-art techniques and applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

PHYS 361 Concepts of Modern Physics
Prerequisites: PHYS 142 or 212 with a grade of C+ or better.
Description: Some of the concepts and ideas underlying modern areas of physics through readings from non-technical works by noted physicists and science writers. Includes quantum mechanics, relativity, cosmology, chaos, and examples of modern technology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

PHYS 391 Undergraduate Research
Prerequisites: Permission.
Description: Research participation.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 8
Format: IND

PHYS 399H Honors Course
Prerequisites: Open to candidates for degrees with distinction, with high distinction, and with highest distinction in the College of Arts and Sciences.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 4
Format: IND

PHYS 401 Computational Physics
Crosslisted with: PHYS 801
Prerequisites: PHYS 311 or parallel.
Description: Re-formulation of physics problems for solution on a computer, control of errors in numerical work, and programming.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

ACE: ACE 10 Integrated Product

PHYS 422 Introduction to Physics and Chemistry of Solids
Crosslisted with: PHYS 822, ECEN 422, ECEN 822
Prerequisites: PHYS 213 or CHEM 481/881, MATH 221/821, or permission.
Description: Introduction to structural, thermal, electrical, and magnetic properties of solids, based on concepts of atomic structure, chemical bonding in molecules, and electron states in solids. Principles underlying molecular design of materials and solid-state devices.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

PHYS 431 Thermal Physics
Crosslisted with: PHYS 831
Prerequisites: PHYS 213
Description: Thermal phenomena from the point of view of thermodynamics, kinetic theory, and statistical mechanics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

PHYS 441 Experimental Physics I
Crosslisted with: PHYS 841
Prerequisites: PHYS 213, 223, and 231; or permission
Notes: Lab fee required.
Description: Methods and techniques of modern experimental physics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

ACE: ACE 10 Integrated Product

PHYS 442 Experimental Physics II
Crosslisted with: PHYS 842
Prerequisites: PHYS 441/841 or permission
Description: Continuation of PHYS 441/841.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

ACE: ACE 10 Integrated Product
PHYS 443 Experimental Physics III  
**Crosslisted with:** PHYS 843  
**Prerequisites:** PHYS 442/842 or permission.  
**Description:** Continuation of PHYS 442/842.  
**Credit Hours:** 1-3  
**Min credits per semester:** 1  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 451 Electromagnetic Theory  
**Crosslisted with:** PHYS 851  
**Prerequisites:** PHYS 213; MATH 221/821.  
**Description:** Theory of electric and magnetic fields and their interaction with charges and currents, Maxwell's equations, electric and magnetic properties of matter.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 452 Optics and Electromagnetic Waves  
**Crosslisted with:** PHYS 851  
**Prerequisites:** PHYS 451/851  
**Description:** Production of electromagnetic waves, wave guides and cavities, properties of waves, plane waves, reflection and refraction, interference and coherence phenomena, polarization. Optical properties of matter.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 461 Quantum Mechanics  
**Crosslisted with:** PHYS 861  
**Prerequisites:** PHYS 213 and 311; or permission.  
**Description:** Basic concepts and formalism of quantum mechanics with applications to simple systems.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 462 Atoms, Nuclei, and Elementary Particles  
**Crosslisted with:** PHYS 862  
**Prerequisites:** PHYS 461 or permission  
**Description:** Basic concepts and experimental foundation for an understanding of the physics of atoms, nuclei, and elementary particles.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 480 Introduction to Lasers and Laser Applications  
**Crosslisted with:** ECEN 480, ECEN 880, PHYS 880  
**Prerequisites:** PHYS 213/(UNO) PHYS 2130.  
**Description:** Physics of electronic transition production stimulated emission of radiation. Threshold conditions for laser oscillation. Types of lasers and their applications in engineering.  
**Credit Hours:** 3  
**Max credits per semester:** 3  
**Max credits per degree:** 3  
**Format:** LEC

PHYS 491 Special Topics in Physics  
**Crosslisted with:** PHYS 891  
**Prerequisites:** PHYS 213 and permission.  
**Description:** Topics vary.  
**Credit Hours:** 1-3  
**Min credits per semester:** 1  
**Max credits per semester:** 3  
**Max credits per degree:** 9  
**Format:** LEC