**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

**PHYS 141 Elementary General Physics I**
*Prerequisites:* MATH 102 or higher; or qualifying score on Math Placement Exam for MATH 106 or higher.
*Notes:* Credit toward the degree may be earned in only one of: PHYS 141, 141H and 151.
*Description:* Mechanics, heat, waves and sound.

*Credit Hours:* 5

**PHYS 141H Honors: Elementary General Physics I**
*Prerequisites:* Good standing with the University Honors Program; MATH 102 or higher; or qualifying score on Math Placement Exam for MATH 106 or higher.
*Notes:* Credit toward the degree may be earned in only one of: PHYS 141, 141H and 151.
*Description:* For course description, see PHYS 141.

*Credit Hours:* 5

**PHYS 142 Elementary General Physics II**
*Prerequisites:* PHYS 141 or 141H.
*Notes:* Lab fee required.
*Description:* Continuation of PHYS 141. Electricity, magnetism, optics, relativity, atomic and nuclear physics.

*Credit Hours:* 5

**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.

**PHYS 151 Elements of Physics**
*Prerequisites:* MATH 102 or higher; or qualifying score on Math Placement Exam for MATH 106 or higher.
*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

**PHYS 153 Elements of Physics Laboratory**
*Prerequisites:* PHYS 151 or parallel.
*Notes:* Optional lab to accompany PHYS 151.
*Description:* Laboratory experiments in mechanics, heat, and wave motion.

*Credit Hours:* 1

**PHYS 198 Special Topics in Physics**
*Topic varies.*
*Credit Hours:* 1-6

**PHYS 201 Modern Topics in Physics and Astronomy**
*Prerequisites:* Must be a PHYS major or minor with freshman or sophomore status.
*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
PHY 211 General Physics I
Prerequisites: MATH 106 or parallel
Notes: One year of either high school physics or algebra-based college physics is expected.
Description: Continuation of PHYS 211. Electricity, magnetism, and heat.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: PHYS 222, PHYS 231, PHYS 311, PHYS 343

PHY 212 General Physics II
Prerequisites: MATH 106 or parallel
Notes: One year of either high school physics or algebra-based college physics is expected.
Description: Continuation of PHYS 211. Electricity, magnetism, and heat.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: PHYS 231

PHY 213 General Physics III
Prerequisites: PHYS 212 or 212H; MATH 208 or 208H 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
Grading Option: Graded with Option
Prerequisite for: PHYS 222

PHY 211H Honors: General Physics I
Prerequisites: Physics major or good standing with the University Honors Program; MATH 106 or parallel.
Notes: Ambitious students who are not in the Honors Program are encouraged to request permission to enroll.
Description: For course description, see PHYS 211.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: PHYS 222

PHY 212H Honors: General Physics II
Prerequisites: Physics major or good standing with the University Honors Program; PHYS 211 or 211H; MATH 107 or 107H or parallel.
Notes: Ambitious students who are not in the Honors Program are encouraged to request permission to enroll.
Description: For course description, see PHYS 212.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: PHYS 231

PHY 213H Honors: General Physics III
Prerequisites: Physics major or good standing with the University Honors Program; PHYS 212 or 212H; MATH 208 or 208H, or parallel.
Notes: Ambitious students who are not in the Honors Program are encouraged to request permission to enroll.
Description: For course description, see PHYS 213.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: PHYS 223

PHY 221 General Physics Laboratory I
Prerequisites: PHYS 211 or 211H or parallel.
Notes: Optional lab to accompany PHYS 211.
Description: Experiments in electromagnetism and optics.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: PHYS 222

PHY 222 General Physics Laboratory II
Prerequisites: PHYS 212 or 212H or parallel.
Notes: Optional lab to accompany PHYS 212.
Description: Laboratory experiments in electromagnetism and optics.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: PHYS 223

PHY 223 General Physics Laboratory III
Prerequisites: PHYS 213 or 213H or parallel.
Notes: Optional lab to accompany PHYS 213.
Description: Experiments in atomic and nuclear physics.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: PHYS 231

PHY 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
Grading Option: Graded with Option
Prerequisite for: PHYS 231
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Notes</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Max credits per semester</th>
<th>Max credits per degree</th>
<th>Grading Option</th>
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<tbody>
<tr>
<td>PHYS 260</td>
<td>Liberal Arts Physics: Matter and Motion</td>
<td>Prerequisites: MATH 101 or higher; or qualifying score on Math Placement Exam</td>
<td>Notes: PHYS 260 and 261 are independent and may be taken in any order.</td>
<td>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</td>
<td>Max credits per semester: 3</td>
<td>Max credits per degree: 3</td>
<td>Graded with Option</td>
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<td>ACE 10 Integrated Product</td>
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<td>PHYS 261</td>
<td>Liberal Arts Physics: Atoms and Fields</td>
<td>Prerequisites: MATH 101 or higher; or qualifying score on Math Placement Exam</td>
<td>Notes: Intended for students planning to be elementary or middle-level teachers</td>
<td>Description: Selected physical science concepts using inquiry methods. Credit Hours: 3</td>
<td>Max credits per semester: 3</td>
<td>Max credits per degree: 3</td>
<td>Graded with Option</td>
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<td>PHYS 262</td>
<td>Physical Sciences by Inquiry</td>
<td>Prerequisites: PHYS 260 or PHYS 261 or parallel.</td>
<td>Notes: Permission.</td>
<td>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</td>
<td>Max credits per semester: 1</td>
<td>Max credits per degree: 1</td>
<td>Graded with Option</td>
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<td>PHYS 298</td>
<td>Special Topics in Physics</td>
<td>Prerequisites: Permission.</td>
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<td>Description: Introduction to Physics and Chemistry of Solids Crosslisted with: PHYS 822, ECEN 422, ECEN 822</td>
<td>Max credits per semester: 1</td>
<td>Max credits per degree: 1</td>
<td>Graded with Option</td>
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<td>PHYS 311</td>
<td>Mechanics</td>
<td>Prerequisites: PHYS 212 or 212H or parallel, MATH 221 or 221H or parallel.</td>
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<td>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</td>
<td>Max credits per semester: 3</td>
<td>Max credits per degree: 3</td>
<td>Graded with Option</td>
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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
Grading Option: Graded with Option

PHYS 441 Experimental Physics I
Crosslisted with: PHYS 841
Prerequisites: PHYS 213, 223 and 231
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
Grading Option: Graded with Option

PHYS 442 Experimental Physics II
Crosslisted with: PHYS 842
Prerequisites: PHYS 441/841 or permission
Notes: Lab fee required.
Description: Continuation of PHYS 441/841.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option

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
Grading Option: Graded with Option

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
Grading Option: Graded with Option

PHYS 452 Optics and Electromagnetic Waves
Crosslisted with: PHYS 852
Prerequisites: A grade of P, C or better in 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
Grading Option: Graded with Option

PHYS 461 Quantum Mechanics
Crosslisted with: PHYS 861
Prerequisites: A grade of P, C or better in PHYS 213 and 311.
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
Grading Option: Graded with Option

PHYS 462 Atoms, Nuclei, and Elementary Particles
Crosslisted with: PHYS 862
Prerequisites: A grade of P, C or better in PHYS 461
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
Grading Option: Graded with Option

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
Grading Option: Graded with Option

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
Grading Option: Graded with Option