

PHYSICS (PHYS)

PHYS 100 Physical Science (4 crs)

Prerequisite: No credit if taken after PHYS 110, PHYS 111, PHYS 211 or PHYS 231.

A conceptual study of physics using ideas of force and energy to understand motion, properties of matter, sound, light, and electricity and magnetism.

Attributes: GE II Natural Sciences, Lab Science, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

PHYS 115 Survey of Astronomy (3 crs)

Prerequisite: No credit if taken after PHYS 226 or PHYS 229.

A one-semester presentation of our current understanding of the universe, including the solar system, birth and death of stars, unusual phenomena such as black holes and quasars, evolution of galaxies and the universe, and our link with the cosmos.

Attributes: GE II Natural Sciences, LE-K1 Natural Sciences

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 186 Introductory Seminar (0.5 crs)

Prerequisite: Limited to physics liberal arts majors.

Students will explore avenues for obtaining an internship, discuss plans for participating in the required research project, attend the weekly Physics Seminar, develop academic plans, and participate in postgraduate planning.

Grading Basis: A-F Grades Only

Lecture/Discussion Hours: .5

Lab/Studio Hours: 0

PHYS 205 Physics of Renewable Energy (4 crs)

Explores the basic physics principles behind various types of renewable energy sources. Discusses impact renewable energy sources have on mitigating global warming and climate change.

Attributes: GE II Natural Sciences, Lab Science, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab, LE-R3 Civic and Environmental Issues

Grading Basis: A-F Grades Only

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

PHYS 211 General Physics (5 crs)

Prerequisite: No credit if taken after PHYS 231.

Fundamental principles of mechanics, heat, wave motion, and sound. Designed for students who desire a one-year non-calculus course in physics. Proficiency with algebraic and trigonometric operations is expected.

Attributes: GE II Natural Sciences, Lab Science, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab

Lecture/Discussion Hours: 4

Lab/Studio Hours: 2

PHYS 212 General Physics (4 crs)

Prerequisite: PHYS 211. No credit if taken after PHYS 232.

A continuation of Physics 211 including topics in optics, electricity, magnetism, and modern physics.

Attributes: GE IIE Natural Science-Physics, Lab Science

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

PHYS 226 Astronomy-Solar System (4 crs)

- *Three years high school mathematics assumed prior to enrollment in this course. Some night observing required.*

The physical nature of the solar system, including earth motions, celestial coordinates, time, telescopes, moon, planets, sun, and origin of solar system.

Attributes: GE IIE Natural Science-Physics, Lab Science, LE-I1 Integration, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

PHYS 229 Astronomy-Stars and Galaxies (4 crs)

- *Three years of high school mathematics assumed prior to enrollment in this course. PHYS 226 is not a prerequisite. Some night observing required.*

The physical nature of the universe, including stellar evolution, multiple and variable stars, the Milky Way galaxy, other galaxies, and origin of the universe.

Attributes: GE IIE Natural Science-Physics, Lab Science, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab

Lecture/Discussion Hours: 3

Lab/Studio Hours: 2

PHYS 231 University Physics I (5 crs)

Prerequisite: MATH 114 or concurrent enrollment.

Physics for science and engineering students, including the study of mechanics, simple harmonic motion, and wave motion.

Attributes: GE IIE Natural Science-Physics, Lab Science, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab

Lecture/Discussion Hours: 4

Lab/Studio Hours: 2

PHYS 232 University Physics II (5 crs)

Prerequisite: PHYS 231; MATH 215 or concurrent enrollment

A continuation of Physics 231, including the study of electricity, magnetism, and optics.

Attributes: GE IIE Natural Science-Physics, Lab Science, LE-K1 Natural Sciences, LE-K1L Natural Sciences with Lab

Lecture/Discussion Hours: 4

Lab/Studio Hours: 2

PHYS 240 Computational Physics (3 crs)

Prerequisite: PHYS 231

An introduction to the use of computational tools for solving physical problems. Topics include an introduction to computing, visualization techniques, numerical integration, and numerical solutions to differential equations.

Attributes: Special Course Fee Required

Lecture/Discussion Hours: 2

Lab/Studio Hours: 2

PHYS 255 Statics (3 crs)

Prerequisite: PHYS 231; MATH 215 or concurrent registration.

Designed primarily for pre-engineering students. Includes static equilibrium of rigid bodies, centroids, analysis of structures, friction, and moments of inertia.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 291 Special Topics (1-3 crs)

Content will be determined by the interests of students and faculty. May contain lecture or lab.

PHYS 308 Science of Musical Sound (3 crs)

Physical concepts related to production of tones and speech. Application to musical instruments and auditorium acoustics, with experimental demonstrations of vibrational phenomena and electronic sound analysis and synthesis. No prior physics or university mathematics assumed.

Attributes: GE IIE Natural Science-Physics, LE-K1 Natural Sciences

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 315 The Mysterious Universe (3 crs)

A view of the world as revealed by contemporary physical thought. Topics include size and origin of universe, ultimate nature of matter; modern ideas of space, time and energy; possibilities of extraterrestrial life; and values and limitations of science.

Attributes: GE IIE Natural Science-Physics, LE-I1 Integration, LE-K1 Natural Sciences

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 332 University Physics III (3 crs)

Prerequisite: PHYS 232 and MATH 215.

Physics for science and engineering students, including the study of fluids, heat, thermodynamics, relativity, and an introduction to modern physics.

Attributes: LE-I1 Integration

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 333 Quantum Physics (3 crs)

Prerequisite: PHYS 332, and MATH 216, and PHYS 240 or one of CS 145 or CS 163 or CS 170 and a passing score on Python proficiency exercise.

- If CS 145, CS 163, or CS 170 is taken, contact the department to complete the required Python programming exercise.

Introduction to the experimental and theoretical basis of quantum physics, including particle aspects of radiation, matter waves, Bohr model of the atom, Schrodinger wave mechanics and its application to the hydrogen atom and multi-electron atoms.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 340 Optics (4 crs)

Prerequisite: PHYS 232 and MATH 215.

Lecture and laboratory work cover geometrical and physical optics, image formation, optical instruments, interference, diffraction, polarization, and modern topics including lasers.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 3

PHYS 350 Electric and Electronic Circuits (4 crs)

Prerequisite: MATH 215 and grade of C or above in PHYS 232.

General introduction to electrical circuits and electronics including analysis of DC and AC circuits, simple passive filters, diodes, transistors, operational amplifiers, simple digital electronics, and circuit design and construction.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 3

PHYS 356 Dynamics (3 crs)

Prerequisite: MATH 215 and PHYS 255 (or MATH 255). No credit if taken after MATH 256. Credit may not be earned in both PHYS 356 and PHYS 365.

A continuation of Physics 255. Dynamics of rigid bodies, moments of inertia, work, energy, impulse, and momentum.

Grading Basis: A-F Grades Only

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 360 Electronics (4 crs)

Prerequisite: PHYS 350 or consent of instructor, and PHYS 240 or one of CS 145 or CS 163 or CS 170 and a passing score on Python proficiency exercise.

- If CS 145, CS 163, or CS 170 is taken, contact the department to complete the required Python programming exercise.

Description, analysis, and laboratory measurements of digital and analog devices including transistor amplifiers, operational amplifiers, oscillators, gates, flip-flops, analog-digital converters, and microprocessors.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 3

PHYS 361 LabVIEW Basics (2 crs)

Prerequisite: PHYS 350 or concurrent enrollment.

Consent: Instructor Consent Required

- *Field trip(s) optional.*

Lecture and laboratory work cover an introduction to the graphical programming language LabVIEW. LabVIEW has been widely adopted as the industry standard for computerized data acquisition, analysis and instrument control.

Attributes: Undergraduate/Graduate Offering

Grading Basis: A-F Grades Only

Lecture/Discussion Hours: 2

Lab/Studio Hours: 0

PHYS 362 LabVIEW Applications (2 crs)

Prerequisite: PHYS 361 LabVIEW Basics

Consent: Instructor Consent Required

- *Field trip(s) optional.*

Lecture and laboratory exercises cover applications using the graphical programming language LabVIEW. Topics include advanced programming structures, CompactDAQ hardware, digital signal processing, motor control, encoders, PID process control, RS-232 instrument control, component testing, sensor monitoring.

Attributes: Undergraduate/Graduate Offering

Lecture/Discussion Hours: 2

Lab/Studio Hours: 0

PHYS 363 LabVIEW cRIO (1 cr)

Prerequisite: PHYS 362 LabVIEW Applications

Consent: Instructor Consent Required

Lecture and laboratory exercises cover the theory and application of the cRIO automation controller using the graphical programming language LabVIEW. Topics include Real-Time operating system, field programmable gate array (FPGA) and network shared variables.

Attributes: Undergraduate/Graduate Offering

Lecture/Discussion Hours: 1

Lab/Studio Hours: 0

PHYS 365 Theoretical Mechanics (4 crs)

Prerequisite: MATH 216, and a grade of C or above in PHYS 231, and PHYS 240 or one of CS 145 or CS 163 or CS 170 and a passing score on Python proficiency exercise. Credit may not be earned in both PHYS 356 and PHYS 365.

- *If CS 145, CS 163, or CS 170 is taken, contact the department to complete the required Python programming exercise.*

Newton's laws, accelerated frames, central-force orbits, angular momentum of systems, coupled oscillations, generalized coordinates, and Lagrange's equations.

Lecture/Discussion Hours: 4

Lab/Studio Hours: 0

PHYS 367 Astrophysics (3 crs)

Prerequisite: PHYS 332, and PHYS 240 or one of CS 145 or CS 163 or CS 170 and a passing score on Python proficiency exercise.

- *If CS 145, CS 163, or CS 170 is taken, contact the department to complete the required Python programming exercise.*

Physics applied to astronomical objects. The birth, structure, and evolution of stars are studied in detail. Nebulae, the interstellar medium, and stellar remnants are also investigated.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 374 Electrical, Optical and Magnetic Properties of Materials (4 crs)

Prerequisite: PHYS 332 or MSE 350

- *Credit may not be earned in both MSE 374 and PHYS 374.*

A description of the behaviors of crystalline solids. Topics include crystallography, diffraction, and the electrical, optical and magnetic properties of materials. Semiconducting materials and devices will also be discussed.

Lecture/Discussion Hours: 4

Lab/Studio Hours: 0

PHYS 375 Electromagnetic Fields (4 crs)

Prerequisite: PHYS 332, MATH 216, and MATH 311 or MATH 312, and PHYS 240 or one of CS 145 or CS 163 or CS 170 and a passing score on Python proficiency exercise.

- *If CS 145, CS 163, or CS 170 is taken, contact the department to complete the required Python programming exercise.*

Electric and magnetic fields, dielectric and magnetic properties of materials, and electromagnetic phenomena. Field theory leading to the development of Maxwell's equations and the plane electromagnetic wave.

Lecture/Discussion Hours: 4

Lab/Studio Hours: 0

PHYS 399 Independent Study - Juniors (1-3 crs)

Prerequisite: Minimum junior standing.

Consent: Department Consent Required

Individual project under the direction of a faculty member.

Repeat: Course may be repeated

PHYS 430 Advanced Laboratory Techniques (2 crs)

Prerequisite: Two courses from PHYS 340, PHYS 350, PHYS 360.

Laboratory course for students with special interests in experimental physics. The emphasis is on widely applicable modern experimental methods.

Lecture/Discussion Hours: 0

Lab/Studio Hours: 4

PHYS 440 Digital Image Processing (3 crs)

Prerequisite: MATH 215

- *Credit may not be earned in both MATH 440 and PHYS 440.*

Applications of Fourier analysis and wavelets to optics and image processing. Topics include: diffraction, wave optical theory of lenses and imaging, wavelets, and image processing.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 445 Thermal Physics (4 crs)

Prerequisite: PHYS 332, and MATH 216, and PHYS 240 or one of CS 145 or CS 163 or CS 170 and a passing score on Python proficiency exercise. No credit if taken after PHYS 334 and PHYS 435.

- *If CS 145, CS 163, or CS 170 is taken, contact the department to complete the required Python programming exercise.*

Statistical mechanics and thermodynamics including the laws of classical thermodynamics, equations of state, thermodynamical processes, and applications to classical and quantum mechanical systems.

Lecture/Discussion Hours: 4

Lab/Studio Hours: 0

PHYS 465 Quantum Mechanics (3 crs)

Prerequisite: PHYS 333, MATH 311 or MATH 312.

A continuation of Physics 333, including Dirac notation, operator methods, one dimensional potentials, spin and angular momentum, and the philosophical interpretation of quantum mechanics.

Lecture/Discussion Hours: 3

Lab/Studio Hours: 0

PHYS 486 Senior Seminar (0.5 crs)

Prerequisite: Limited to physics liberal arts majors, liberal arts emphasis; and physics liberal arts majors, applied physics emphasis.

Consent: Department Consent Required

- *Students need to have completed an adviser-approved capstone project before entering this class. This can be accomplished through various means: PHYS 392, PHYS 399, PHYS 430, PHYS 495, PHYS 499, through an academic or industrial internship, or through another approved means.*

Students will present a capstone project seminar, develop presentation skills (oral and poster), take a nationally normed test covering undergraduate physics, discuss their post-graduate plans, and assist the department in assessing the major.

Attributes: LE-S3 Creativity

Lecture/Discussion Hours: .5

Lab/Studio Hours: 0

PHYS 491 Special Topics (1-4 crs)

Prerequisite: PHYS 333 and PHYS 365.

Content will be determined by the interests of students and faculty. Possible topics include astrophysics and solid state physics.

Repeat: Course may be repeated for a maximum of 6 credits

PHYS 495 Directed Study (1-3 crs)

Prerequisite: PHYS 332; 2.75 GPA in physics. Limited to physics majors and minors.

Consent: Department Consent Required

- *Limit of three credits counted toward major.*

Special project or research activity, primarily on campus, and directed by a faculty member. Projects and topics available will be determined by the activities and interests of the faculty.

Repeat: Course may be repeated for a maximum of 6 credits

PHYS 499 Independent Study - Seniors (1-3 crs)

Prerequisite: Minimum senior standing.

Consent: Department Consent Required

Individual project under the direction of a faculty member.

Repeat: Course may be repeated

PHYS 793 Directed Studies (1-4 crs)

Permits groups of students to study topical areas in an intensive way under the direction of departmental faculty members.

Repeat: Course may be repeated

Grading Basis: No S/U Grade Option