

PHYSICS (PHYSCS)

Courses

PHYSCS 100 ENERGY (GM) 3 Units

An examination of energy; its nature, the forms in which it appears, its transformation, current and future sources, and energy issues faced by an informed electorate. Three one-hour lectures per week.

PHYSCS 120 LIGHT AND COLOR 4 Units

An introduction to light science for students in the visual arts and for students with an interest in art. The course includes the properties of light and color, the interaction of light with matter, the formation of visual images and color vision.

COREQ: MATH 139 OR MATH 140 OR MATH 141 OR WAIVER

PHYSCS 130 PHYSICS FOUNDATIONS (GL) 5 Units

This course will explore topics in classical physics (motion, heat, sound, electricity, magnetism, and light) and modern physics (atomic structure, quantum mechanics, and relativity) with an emphasis on how the principles explain and predict phenomena we observe every day. Four one-hour lectures and one two-hour laboratory per week.

COREQ: MATH 139 OR MATH 141 OR CONSENT OF INSTRUCTOR

UNREQ: PHYSCS 212

UNREQ: PHYSCS 130 AND PHYSCS 212

PHYSCS 140 PRINCIPLES OF PHYSICS I (GL) 5 Units

An algebra-based course in classical mechanics at the introductory level. The content covers kinematics, Newton's laws, conservation laws, oscillations and waves, applications to fluids and elasticity, and thermodynamics and kinetic theory. Applications to the life and health sciences are emphasized, and essential MCAT subject matter is included. Basic understanding of trigonometry and the manipulation of vectors is necessary. Students with adequate mathematical preparation may wish to consider taking the PHYSCS 180 series. Four one-hour lectures and one three-hour laboratory per week.

COREQ: MATH 152

UNREQ: PHYSCS 160 AND PHYSCS 170

PHYSCS 141 PRINCIPLES OF PHYSICS II (GL) 5 Units

An algebra-based course in electricity and magnetism, circuits, electromagnetic waves, optics and an introduction to modern physics. Applications to the life and health sciences are emphasized, and essential MCAT subject matter is included. Basic understanding of trigonometry and the manipulation of vectors is necessary. Students with adequate mathematical preparation may wish to consider taking the PHYSCS 180 series. Four One-hour lectures and one three-hour laboratory per week.

PREREQ: PHYSCS 140

PHYSCS 150 FROM EINSTEIN TO STAR TREK (GM) 3 Units

This introductory survey course will focus on areas of modern physics that are frequently discussed but often misunderstood. The theories of Einstein and other physicists will be used to examine science fiction devices such as time machines, warp drives, and mass transporters. Integrated throughout will be a discussion of what are science, science fiction, and pseudo-science.

COREQ: MATH 139 OR MATH 140 OR MATH 141 OR WAIVER

PHYSCS 180 PHYSICS FOR SCIENTISTS AND ENGINEERS I (GL) 5 Units

A lecture course in introductory physics including a mathematically rigorous analysis of mechanics, vibrations, wave motion, and thermodynamics using calculus. For majors and minors in physics, engineering, chemistry, mathematics. Four one-hour lectures and one three-hour lab per week. High school calculus recommended.

COREQ: MATH 253

PHYSCS 181 PHYSICS FOR SCIENTISTS AND ENGINEERS II (GL) 5 Units

A course in introductory physics including a mathematically rigorous analysis of electricity and magnetism, light and optics, and modern physics using calculus. For majors and minors in physics, engineering, chemistry, and mathematics. Four one-hour lectures and one three-hour lab per week.

PREREQ: PHYSCS 180 OR CONSENT OF INSTRUCTOR; COREQ: MATH 254

PHYSCS 190 FRONTIERS OF ENGINEERING AND PHYSICS Repeatable 1 Units

An introduction to career tracks and career opportunities in engineering and physics. This course will feature readings on different career possibilities in engineering and physics and visiting lectures by practicing physicists and engineers. Professional skills, identification of career tracks, and scientific and technical communication will be emphasized. One hour lecture per week.

PHYSCS 212 PHYSICS FOR ELEMENTARY TEACHERS 4 Units

An activity-based, hands-on learning course that focuses on conceptual understanding of physics phenomena. The course emphasizes a student-oriented pedagogy. Topics include motion, forces, energy, light, heat, electricity, and magnetism as well as the nature of science. Elementary education students will find this course particularly helpful as it explores ideas related to how children and students learn physics.

PREREQ: MATH 141 OR MATH 139 AND RESTRICTED TO STUDENTS WITH BSE PROGRAM OR INSTRUCTOR CONSENT UNREQ: PHYSCS 130

PHYSCS 221 INTERMEDIATE LABORATORY 2 Units

A laboratory course concentrating on techniques of recording, interpretation of, and reporting experimental data. Extensive use will be made of computers in data processing. Topics covered include data acquisition and the recording of data, error analysis, numerical analysis, graphing techniques, computational tools and report writing.

PREREQ: (PHYSCS 181 OR PHYSCS 141) AND MATH 254

PHYSCS 240 PHYSICS OF SOUND AND MUSIC 3 Units

A descriptive course that deals with various properties of sound, the generation of sound by traditional musical instruments and the electronic production and reproduction of sound. The physical process of hearing and the acoustical properties of rooms are also included.

COREQ: MATH 139 OR MATH 140 OR MATH 141

PHYSCS 290 PHYSICS RECITATIONS I 1 Units

Topics include, limits, increments and infinitesimals and their applications to physical problems, differentiation and differentials in physics, integration as anti-differentiation and integration of higher derivatives (application to kinematics in one dimension), vector and coordinate frames: application to kinematics in two and three dimensions, definite integrals and the integral as an area: application to mechanical energy and work. One-hour lecture per week.

COREQ: MATH 253 OR CONSENT OF INSTRUCTOR

PHYSCS 291 PHYSICS RECITATIONS II 1 Units

Topics include partial derivatives, increments, and total derivatives: application to force and potential energy, linear momentum, angular momentum, and the dynamics of systems, integrals in two and three dimensions: application to the dynamics of rigid bodies including rotations and forces in equilibrium. One-hour lecture per week.

PREREQ: PHYSCS 290 OR CONSENT OF INSTRUCTOR

PHYSCS 305 MECHANICS - STATICS 3 Units

A study of forces on rigid bodies in equilibrium. Topics include force systems, equilibrium, distributed forces, structures, friction, internal forces, centroids and moments of inertia. This course also introduces notations and operations associated with tensor calculus.

PREREQ: PHYSCS 181 OR PHYSCS 141 AND MATH 254

PHYSCS 310 MECHANICS - DYNAMICS 3 Units

A study of classical mechanics. Topics will include Newtonian mechanics, Lagrangean and Hamiltonian formalisms, symmetry principles, conservation laws, oscillations, central force and two-body problems, collisions and scattering cross-sections, motion in non-inertial reference frames, and rigid body motion. Required of all majors and minors in physics. Three one-hour lectures per week.

PREREQ: PHYSCS 324 WITH A GRADE OF C OR BETTER

PHYSCS 316 INTRODUCTION TO MATERIALS SCIENCE 3 Units

An introduction to materials science with emphasis on general properties of materials. Topics will include bonding, crystal structure, defects in materials, failure, phase diagrams, and mechanical, electrical, optical, thermal and magnetic properties of metals, ceramics, electronic materials, composites and organic materials.

PREREQ: (PHYSCS 181 OR PHYSCS 141) AND CHEM 102 OR CONSENT OF INSTRUCTOR

PHYSCS 321 INTRODUCTION TO NANOTECHNOLOGY 3 Units

Since nanotechnology is an interdisciplinary field, students taking this course will develop a cross-disciplinary communication. They will learn the basics of physical phenomena at nanoscales. Through the in-class experimental activities, students will gain hands-on experience and will develop a better understanding of most common tools used in nanotechnology.

PREREQ: PHYSCS 130 OR PHYSCS 141 OR PHYSCS 181 OR CONSENT OF INSTRUCTOR

PHYSCS 324 METHODS OF THEORETICAL PHYSICS 4 Units

Topics covered include methods of theoretical physics, vector analysis, differential equations of mathematical physics, analytic functions and integration in the complex plane, Laplace transforms, Fourier series, Fourier transforms, and their applications in physics.

PREREQ: (PHYSCS 181 OR PHYSCS 141) AND MATH 254

PHYSCS 325 CLASSICAL ELECTROMAGNETISM 3 Units

A study of the electrostatic field, electric multipoles, dielectrics, special methods in electrostatics, the magnetic field, magnetic materials, time-varying fields, conservation laws, and electromagnetic waves. Three one-hour lectures per week.

PREREQ: PHYSCS 324

PHYSCS 330 ANALOG AND DIGITAL ELECTRONICS 4 Units

An introductory lab-based course in electronics with emphasis on solid state devices, diode and amplifier circuits, waveform generation, operational amplifiers, digital circuitry and microcomputer applications to physical measurement.

PREREQ: PHYSCS 221

PHYSCS 344 MODERN PHYSICS 4 Units

Topics covered include relativity, selected topics of 20th century physics, atomic and molecular structure, elementary quantum physics and its applications in modern technology, elementary nuclear physics and fundamental particles. Laboratory experiments complement material presented in lectures.

PREREQ: (PHYSCS 181 OR PHYSCS 141) AND MATH 254

PHYSCS 360 OPTICS 4 Units

This course provides an introductory study of optical phenomena. Geometrical and physical optics beginning with a mathematical treatment of light waves and their interaction with materials. Topics also include interference diffraction, spectroscopy and spectroscopic instruments, polarization, light sources and detectors, lasers, holography, and some topics in modern optics. Three one-hour lectures and one three-hour laboratory per week.

PREREQ: PHYSCS 324

PHYSCS 364 THERMAL PHYSICS 3 Units

A study of the Laws of Thermodynamics and Statistical Mechanics. Thermodynamic topics include potentials, equilibrium, phase transitions and critical phenomena with applications to gasses, liquids and solids. Statistical Mechanics topics include Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics.

PREREQ: PHYSCS 324 WITH A C OR BETTER AND EITHER PHYSCS 344 OR PHYSCS 425

PHYSCS 389 JUNIOR SEMINAR 1 Units

Students will become familiar with physics literature and learn to write abstracts and project proposals. They will demonstrate proper methods of verbal and visual presentation by delivering a graded series of talks, concluding with a satisfactory colloquium on a physics topic. Students will also learn about career, internship, and graduate school opportunities and prepare materials for future applications.

PREREQ: JUNIOR STANDING AS A PHYSICS MAJOR OR PERMISSION OF INSTRUCTOR

PHYSCS 424 VIBRATIONS AND WAVES 3 Units

This course emphasizes the relationship between vibrations and waves. Topics include free and damped vibrations in linear and non-linear systems with one- and several-degrees of freedom, longitudinal and transverse waves, and the wave equation. Analytic treatment and applications to real phenomena are stressed throughout this course.

PREREQ: PHYSCS 324

PHYSCS 425 QUANTUM MECHANICS 3 Units

This course will explore the tools and postulates of Quantum Mechanics. Topics will include one and three-dimensional problems, angular momentum, as well as approximation methods such as time independent perturbation theory, and Wentzel-Kramers-Brillouin (WKB) methods. Three one-hour lectures per week.

PREREQ: PHYSCS 324

PHYSCS 489 SENIOR SEMINAR 1 Units

Students will review introductory and upper-level topics covered as part of the physics major. This course will consist of weekly homework sets and quizzes to prepare students for the Physics Major Field Test as the final exam for the course. Students will also learn about career and graduate school options and meet with visiting engineers and physicists.

PREREQ: SENIOR STANDING AS A PHYSICS MAJOR OR CONSENT OF INSTRUCTOR

PHYSCS 490 WORKSHOP Repeatable 1-8 Units

Variable topics. Group activity oriented presentations emphasizing 'hands on' and participatory instructional techniques. Repeatable for a maximum of 3 credits in major or minor in physics.

PHYSCS 491 TRAVEL STUDY *Repeatable* 1-3 Units

Variable topics. Faculty-led field courses.

PHYSCS 493 PHYSICS COOPERATIVE EDUCATION 1 Units

The course gives the student an opportunity to intersperse full time study with full time employment. The student will be interviewed by a potential employer identified by the Physics Department. If accepted as an employee, the student may work from one to four terms. A work term is defined as a semester or a summer of employment. No more than two credits may be counted towards the Physics Major. A written report is required.

PREREQ: PHYSICS 181

PHYSCS 494 PHYSICS SEMINAR *Repeatable* 1 Units

Variable topics. Group activity. An advanced course of study in a defined subject matter area emphasizing a small group in intense study with a faculty member. Repeatable.

PREREQ: SENIOR STATUS

PHYSCS 496 SPECIAL STUDIES *Repeatable* 1-10 Units

Variable topics. Group activity. Not offered regularly in the curriculum but offered on topics selected on the basis of timeliness, need, and interest, and generally in the format of regularly scheduled Catalog offerings.

Repeatable for a maximum of 3 credits in major or minor in physics.

PREREQ: MAJOR OR MINOR IN PHYSICS, JUNIOR OR SENIOR STANDING AND CONSENT OF INSTRUCTOR

PHYSCS 497 EXCHANGE STUDY *Repeatable* 1-12 Units

Variable Topics

PHYSCS 498 INDEPENDENT STUDY *Repeatable* 1-3 Units

Study of a selected topic or topics under the direction of a faculty member. Repeatable for a maximum of 3 credits in major or minor in physics.

PREREQ: JUNIOR/SENIOR STATUS OR CONSENT OF INSTRUCTOR

PHYSCS 498R INDEPENDENT STUDENT - UNDERGRADUATE RESEARCH *Repeatable* 1-3 Units

Study of a selected topic or topics under the direction of a faculty member. Repeatable for a maximum of 3 credits in major or minor in physics.

PREREQ: JUNIOR/SENIOR STATUS OR CONSENT OF INSTRUCTOR