

Undergraduate Course Descriptions Effective Fall 2007

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Physics

PH 0010 - Development of Physics Skills

Individualized instruction in physics problem solving and general study skills from professional physics coaches. Benefits students looking for help with demanding introductory physics courses (PH1110, PH1210, PH2100, PH2200). Credits do not count toward graduation.

Credits: 0.0; May be repeated

Semesters Offered: Fall, Spring

Restrictions: Permission of instructor required

PH 0020 - Team Approach to Learning Physics

Students meet 2 hours/week with 4 to 6 team members taking the same introductory physics course. Students work with a professional physics coach to learn the team approach to physics problem solving. Benefits students looking for help with demanding courses who desire experience in team problem solving. Credits do not count toward graduation.

Credits: 0.0; May be repeated

Semesters Offered: Fall, Spring

Restrictions: Permission of instructor required

PH 1090 - The Physics Behind Music

Physics concepts and methods associated with musical instruments, musical recording, and musical acoustics are discussed at an introductory level. Topics include periodic motion, normal modes and resonance, superposition and Fourier series, waves, sound and acoustics, magnetism and electromagnetic induction, and topics from non-linear physics.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): MA 1032(C) or MA 1031(C)

PH 1100 - Physics by Inquiry I

Experiments covering kinematics, force, conservation of momentum, conservation of energy, and waves are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Fall, Spring, Summer

PH 1110 - College Physics I

An overview of basic principles of kinematics, dynamics, elasticity, fluids, heat, thermodynamics, mechanical waves, and interference and diffraction of mechanical waves.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall, Summer

Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics

Co-Requisite(s): PH 1111

Pre-Requisite(s): MA 1032 or MA 1031 or MA 1135(C) or MA 1140(C) or MA 1160(C) or MA 1161(C)

PH 1111 - College Physics I Laboratory

Experiments covering kinematics, forces, conservation of momentum and energy, waves, and thermodynamics are explored through guided construction. The course provides inquiry-based laboratory experiences for concepts explored in PH1110.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Fall, Spring, Summer

Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics

Co-Requisite(s): PH 1110

PH 1140 - Applied College Physics I

An algebra-based introduction to classical mechanics and its applications. Topics include kinematics, Newton's laws, impulse and momentum, work and energy, simple harmonic motion, mechanical waves and sound, and temperature and heat.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Restrictions: Must be enrolled in one of the following College(s): School of Technology

Co-Requisite(s): PH 1141

Pre-Requisite(s): MA 1031 or MA 1032 or MA 1140(C) or MA 1160(C) or MA 1161(C)

PH 1141 - Applied College Physics I Laboratory

Experiments covering kinematics, forces, conservation of momentum and energy, waves, and thermodynamics are explored through guided construction. The course provides inquiry-based laboratory experiences for concepts explored in PH1140.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Spring

Restrictions: Must be enrolled in one of the following College(s): School of Technology

Co-Requisite(s): PH 1140

PH 1160 - Honors Physics I - Mechanics

Calculus-based introduction to classical mechanics. Topics include mathematical concepts, kinematics, Newton's laws, the gravitational force, work and energy, and collisions. Also introduces departmental facilities, research within the department, and professional opportunities in physics. Intended for physics majors; highly motivated students seeking an invigorating introduction to physics may enroll with permission of the instructor.

Credits: 4.0

Lec-Rec-Lab: (4-0-0)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Major(s): Applied Physics, Physics

Pre-Requisite(s): PH 1161(C) and (MA 1160(C) or MA 1161(C))

PH 1161 - Introduction to Experimental Physics I

A laboratory complement to PH1160. Experiments covering kinematics, force, conservation of momentum, conservation of energy, waves and thermodynamics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Major(s): Applied Physics, Physics

PH 1200 - Physics by Inquiry II

Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, and geometric optics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): PH 1100 or PH 1111 or PH1141 or PH 1161

PH 1210 - College Physics II

An overview of basic principles of static and dynamic electricity and magnetism, electromagnetic waves, reflection and refraction of light, interference and diffraction of light, special theory of relativity, wave theory of matter, particle theory of electromagnetic waves, theory of the atom, the nucleus, and elementary particles.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring, Summer

Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics

Pre-Requisite(s): PH 1200(C) and PH 1110

PH 1240 - Applied College Physics II

An overview of static and dynamic electricity and magnetism, electromagnetic waves, basic optics, and an introduction to modern and nuclear physics with an emphasis on problem solving and applications.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following College(s): School of Technology

Co-Requisite(s): PH 1200

Pre-Requisite(s): PH 1140

PH 1360 - Honors Physics II - Rotation and Vibration

Continuation of PH 1160. Topics include rotational motion, simple harmonic motion and mechanical waves. Offered first half of spring semester.

Credits: 2.0

Lec-Rec-Lab: (4-0-0)

Semesters Offered: Spring

Co-Requisite(s): PH 1361

Pre-Requisite(s): (PH 1160 or PH 2100) and MA 2160(C)

PH 1361 - Introductory Experimental Physics II

Laboratory complement to PH 1360. Waves, thermodynamics, and electrostatics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Spring

Co-Requisite(s): PH 1360

PH 1600 - Introductory Astronomy

Introduces fundamentals of astronomy. Topics include Kepler's and Newton's laws of motion, origin and evolution of the solar system, galactic astronomy, extra-galactic astronomy, cosmology, and modern instrumentation, including space-based astronomy.

Credits: 2.0

Lec-Rec-Lab: (2-0-0)

Semesters Offered: Fall, Spring

PH 1610 - Introductory Astronomy Lab

Demonstrates fundamentals of astronomy using non-telescopic and telescopic observations, and computer simulations. Topics include angular size measurements, season-dependent measurements, phases of the moon, phases and orbits of planets, brightness of stars, introduction to the use of MTU's Observatory, instrumentation, and applications of computer programs involving cosmology.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Fall

Co-Requisite(s): PH 1600

PH 2010 - Sophomore Seminar

Discussion of recent research and developments in physics.

Credits: 1.0

Lec-Rec-Lab: (0-1-0)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman

PH 2100 - University Physics I-Mechanics

A calculus-based introduction to classical mechanics. Topics include kinematics, Newton's laws, impulse and momentum, work and energy, and the universal law of gravitation.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): PH 1100(C) and (MA 1160 or MA 1161) and MA 2160(C)

PH 2200 - University Physics II-Electricity and Magnetism

A calculus-based introduction to electromagnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, and electromagnetic waves.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): (PH 1200(C) or PH 2261(C)) and (PH 2100 or PH 1160) and MA 2160

PH 2230 - Electronics for Scientists

An introduction to analog and digital electronics with an emphasis on their use in the laboratory. Topics include linear devices and basic linear circuit analysis; diodes; transistors; op-amps; the use of digital components, including logic gates, flip-flops, counters, clocks and microcontrollers, and analog to digital conversions.

Credits: 4.0

Lec-Rec-Lab: (3-0-3)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering

Pre-Requisite(s): PH 2200 or PH 2260

PH 2260 - Honors Physics III - Electricity and Magnetism

Calculus-based introduction to electromagnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, electromagnetic waves and geometrical optics.

Credits: 4.0

Lec-Rec-Lab: (4-0-0)

Semesters Offered: Fall

Pre-Requisite(s): (PH 1160 or PH 2100) and (PH 1200(C) or PH 2261(C)) and MA 2160

PH 2261 - Introduction to Experimental Physics III

A laboratory complement to PH2260. Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, geometric optics, and modern physics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0

Lec-Rec-Lab: (0-0-2)

Semesters Offered: Fall

Pre-Requisite(s): PH 1100 or PH 1161

PH 2300 - University Physics III-Fluids and Thermodynamics

A calculus-based introduction to fluids and thermal physics. Topics include fluid motion, propagation of heat and sound, temperature and the kinetic theory of gases, heat capacity and latent heat, first law of thermodynamics, heat engines and the second law, entropy, and an introduction to statistical mechanics. Offered second half of spring semester.

Credits: 2.0

Lec-Rec-Lab: (4-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 1160 or PH 2100

PH 2400 - University Physics IV-Waves and Modern Physics

A calculus-based introduction to waves and modern physics. Topics include interference and diffraction, special relativity, photons and matter waves, the Bohr atom, wave mechanics, atomic physics, molecular and solid-state physics, and nuclear physics.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered every third year beginning with the 2008-2009 academic year

Pre-Requisite(s): PH 2200 or PH 2260

PH 3110 - Theoretical Mechanics I

An intermediate study of mechanics, including the study of relativistic mechanics, kinematics, Newtonian mechanics of a single particle, oscillations, motion in noninertial reference frames, and gravitation and central-force motion.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3111 - Theoretical Mechanics II

A continuation of PH3110. Includes the study of the dynamics of a system of particles, rigid body motion, Lagrangian and Hamiltonian mechanics, coupled oscillations, and continuous systems.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 3110

PH 3210 - Optics

An introduction to geometrical and physical optics. Topics in geometrical optics include ray analysis of mirrors, lenses, prisms, and optical systems. Topics in physical optics include polarization, interference, interferometry, and diffraction. The laboratory explores optics through experiments in imaging, fiber optics, interferometry, diffraction, polarization, and laser beam propagation.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530(C) or MA 3560)

PH 3300 - Thermodynamics and Statistical Mechanics

Thermodynamic systems, heat, work, laws of thermodynamics, formal mathematical relations, cycles, phase equilibrium, and multicomponent systems. Elementary kinetic theory. Introduction to microscopic view of entropy, ensemble theory, and applications of statistical mechanics.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 2300 or PH 1360

PH 3320 - Methods of Theoretical Physics

Introduction to the techniques and methods frequently encountered in advanced physics with a particular emphasis on application to physical problems. Topics include, but are not limited to, complex numbers, vector analysis, partial differential equations, and integral transforms.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): MA 3160 and MA 3530

PH 3410 - Quantum Physics I

An introduction to the foundations of modern physics and Schrodinger's wave mechanics. Topics include thermal radiation, particle-like properties of radiation, Bohr's model of the atom, matter waves, Schrodinger's wave mechanics, quantization of angular momentum, and the one-electron atom.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3411 - Quantum Physics II

A continuation of PH3410. Includes the study of spin and magnetic interactions, multi-electron atoms, quantum statistics, molecules, solids, and elementary particles.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): PH 3410

PH 3480 - Modern Physics Laboratory

Advanced laboratory techniques emphasized in a series of experiments in modern physics.

Credits: 2.0

Lec-Rec-Lab: (0-0-6)

Semesters Offered: Spring

Pre-Requisite(s): PH 2230

PH 4010 - Senior Physics Colloquium I

Class discussion of the literature in the field of physics. Requires oral and written presentations.

Credits: 1.0

Lec-Rec-Lab: (0-0-3)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Co-Requisite(s): PH 4080

PH 4011 - Senior Physics Colloquium II

A continuation of PH4011. Class discussion of current literature and recent advances in physics. Requires oral and written presentations.

Credits: 1.0

Lec-Rec-Lab: (0-0-3)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Co-Requisite(s): PH 4081

Pre-Requisite(s): PH 4010

PH 4050 - Qualitative Methods in Physics

General methods and approaches of the physicist, including modeling, scaling, numerical estimation, and dimensional analysis as applied to the development, understanding, and solution of physics problems.

Credits: 1.0

Lec-Rec-Lab: (0-1-0)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Major(s): Applied Physics, Physics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

PH 4080 - Senior Research I

Introduction to research under the guidance of a faculty member. In addition, creative problem solving will be assessed via a student-initiated project.

Credits: 3.0

Lec-Rec-Lab: (0-0-6)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Co-Requisite(s): PH 4010

Pre-Requisite(s): PH 3480

PH 4081 - Senior Research II

Continuation of research under the guidance of a faculty member, culminating in a written report and presentation of results at an undergraduate research forum.

Credits: 3.0

Lec-Rec-Lab: (0-0-6)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Co-Requisite(s): PH 4011

Pre-Requisite(s): PH 4080

PH 4090 - Senior Thesis

Students prepare an in-depth written thesis on an approved topic in physics. Normally taken the last semester before graduation in conjunction with PH4081.

Credits: 1.0

Lec-Rec-Lab: (0-0-3)

Semesters Offered: Spring

Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

PH 4210 - Electricity and Magnetism I

Intermediate study of the basic theory of electricity and magnetism, including a detailed study of electrostatic field theory and an introduction to magnetostatics.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): (PH 2200 or PH 2260) and PH 3110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4211 - Electricity and Magnetism II

A continuation of PH4210. Intermediate study of magnetostatics, electrodynamics, and electromagnetic waves.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 4210

PH 4380 - Computers in the Physics Lab

How computers are used for data acquisition, data treatment and analysis, graphics display, and controlling experiments. Develops skills necessary to interface and automate instruments and systems.

Credits: 2.0

Lec-Rec-Lab: (0-0-5)

Semesters Offered: Fall

Pre-Requisite(s): PH 2230

PH 4390 - Computational Methods in Physics

An overview of numerical and computer methods to analyze and visualize physics problems in mechanics, electromagnetism, and quantum mechanics. Utility and potential pitfalls of these methods, basic concepts of programming, UNIX computing environment, system libraries and computer graphics are included.

Credits: 2.0

Lec-Rec-Lab: (2-0-0)

Semesters Offered: Fall

Pre-Requisite(s): PH 3410

PH 4395 - Computer Simulation in Physics

Role of computer simulation in physics with emphasis on methodologies, data and error analysis, approximations, and potential pitfalls. Methodologies may include Monte Carlo simulation, molecular dynamics, and first-principles calculations for materials, astrophysics simulation, and biophysics simulations.

Credits: 3.0

Lec-Rec-Lab: (1-0-4)

Semesters Offered: Spring

Pre-Requisite(s): (PH 3300 or PH 5310) and PH 4390 and (PH 2400 or PH 3410)

PH 4430 - Introduction to Nuclear Physics

Ground state properties of stable nuclei of atoms; modes of disintegration of unstable nuclei; elementary theories of alpha, beta, and gamma decay; and nuclear reactions, including fission and fusion.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 3410 or CH 3520

PH 4510 - Introduction to Solid State Physics

Crystal structures, X-ray diffraction, phonons, free electron theory of metals, rudiments of band theory, an overview of semiconductors, and other topics in solid-state physics.

Credits: 2.0

Lec-Rec-Lab: (2-0-0)

Semesters Offered: Fall

Pre-Requisite(s): (PH 2300 or PH 1360) and PH 2400 and CH 1110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4610 - Stellar Astrophysics

Topics include an overview of observational astrophysics, stellar atmospheres, stellar structure, atomic properties of matter, radiation and energy transport in stellar interiors, and stellar evolution to and from the main sequence.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered every third year beginning with the 2009-2010 academic year

Pre-Requisite(s): PH 1600 and PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4620 - Galactic Astrophysics

Topics include the composition and dynamics of our galaxy, dynamics of stellar encounters, spiral density wave theory, clusters of galaxies, theoretical cosmology, physics of the early universe, and observational cosmology.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered every third year beginning with the 2009-2010 academic year

Pre-Requisite(s): PH 1600 and PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4630 - Particle Astrophysics

Introduction to the twin fields of elementary particle physics and high energy astrophysics. Topics include an overview of particles and interactions, the expanding universe, conservation laws, dark matter and dark energy, large scale structure, and cosmic particles.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring - Offered every third year beginning with the 2007-2008 academic year

Pre-Requisite(s): PH 2400 and (MA 3530 or MA 3520)

PH 4640 - Introduction to Atmospheric Physics

Essential elements of atmospheric physics, including thermodynamics (adiabatic processes, phase transformations, stratification), aerosol and cloud physics (e.g. nucleation, Kohler theory, growth by condensation and collection), radiative transfer (e.g. Beer's law, transfer equations with and without scattering).

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year

Pre-Requisite(s): (PH 2200 or PH 2260) and (PH 1360 or PH 2300) and (MA 3150 or MA 3160) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4999 - Special Topics in Physics

Selected additional topics in physics for advanced students based on interests of faculty and students. Interested students should contact the physics department.

Credits: variable to 9.0; May be repeated

Semesters Offered: Fall, Spring, Summer

Undergraduate Course Descriptions Effective Fall 2007

https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_ug

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